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(continued on next page)

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E21B 43/02 43/14

(52) UK CL (Edition X):
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GB 2348223 A

(58) Field of Search:
UK CL (Edition X) E1F
INT CL⁷ E21B
Other:

(54) Abstract Title: **Isolation of subterranean zones**

(57) An apparatus, comprising: a zonal isolation assembly comprising: one or more solid tubular members, each solid tubular member including one or more external seals; one or more perforated tubular members coupled to the solid tubular members, the perforated tubular members defining a longitudinal flow passage; one or more flow control valves operably coupled to the perforated tubular members for controlling the flow of fluidic materials through the perforated tubular members; one or more temperature sensors located within the longitudinal flow passage of one or more of the perforated tubular members for monitoring the operating temperature within the perforated tubular members; one or more pressure sensors located within the longitudinal flow passage of one or more of the perforated tubular members for monitoring the operating pressure within the perforated tubular members; and one or more flow sensors located within the longitudinal flow passage of one or more of the perforated tubular members for monitoring the operating flow rate within the perforated tubular members; and a shoe coupled to the zonal isolation assembly; and a controller operably coupled to the flow control valves, the temperature sensors, the pressure sensors, and the flow sensors for monitoring the temperature, pressure and flow sensors and controlling the operation of the flow control valves; and wherein at least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore; and an expansion device adapted to radially expand at least one of the solid tubular members or at least one of the perforated tubular members, where the expansion device has first and second outer conical sections.

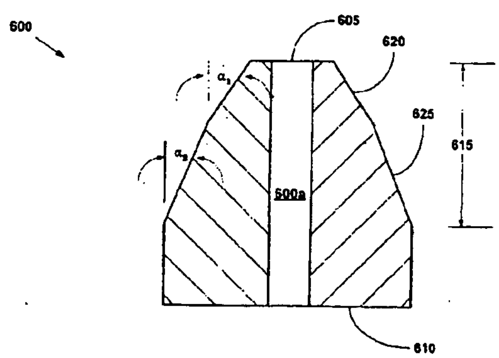

Fig. 6

GB 2413136

GB 2413136 A continuation

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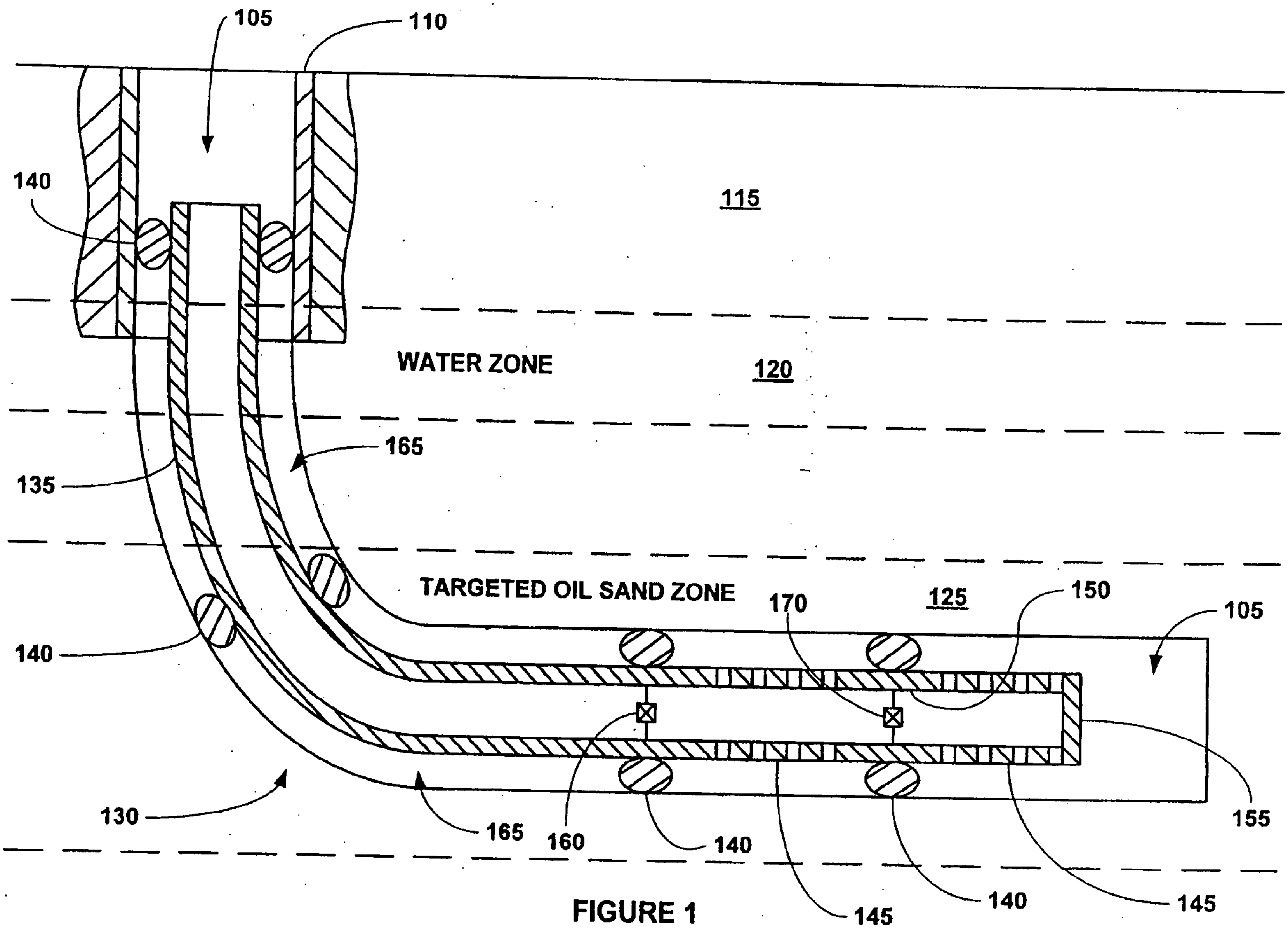
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FIGURE 1

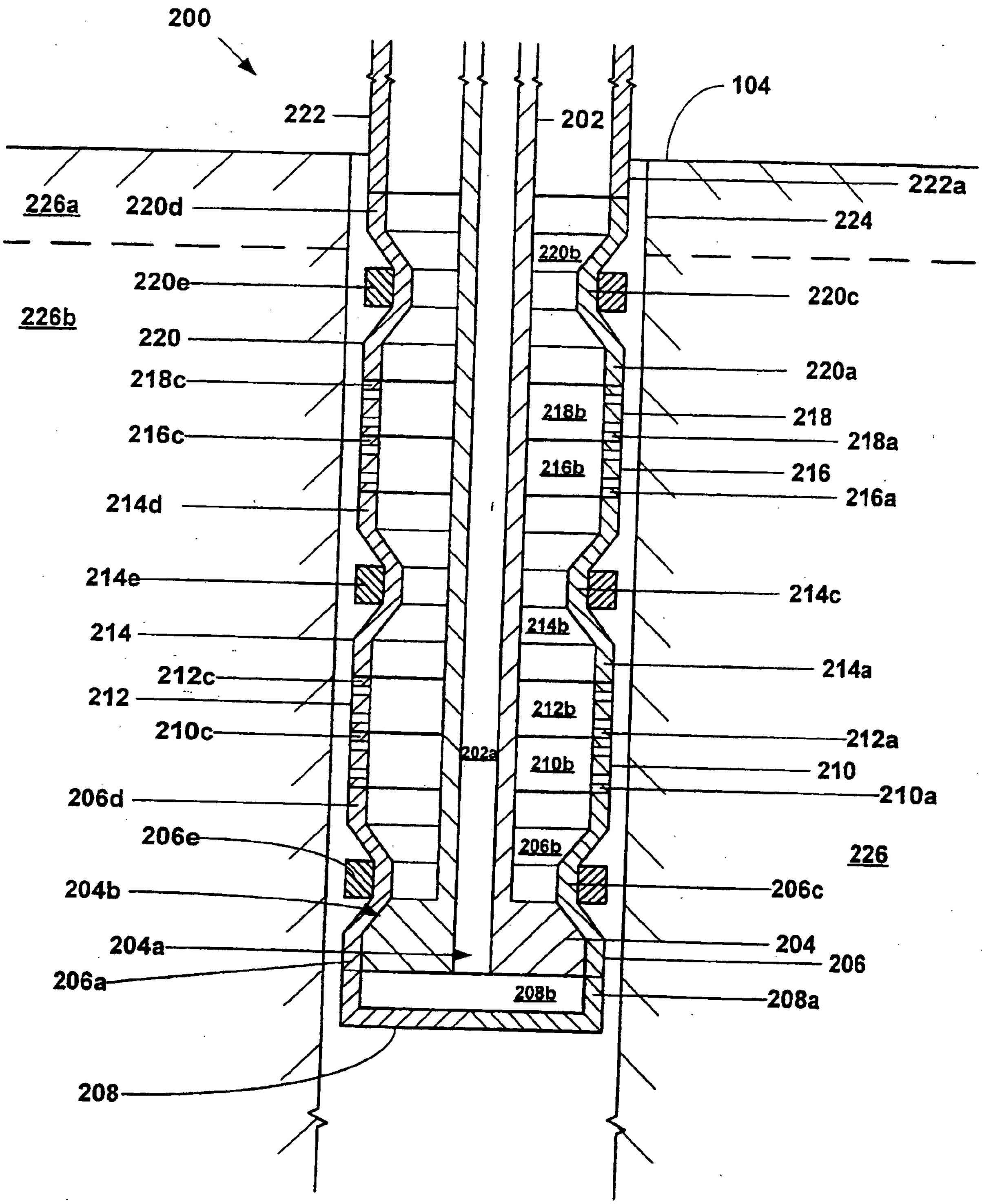

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Fig. 2a

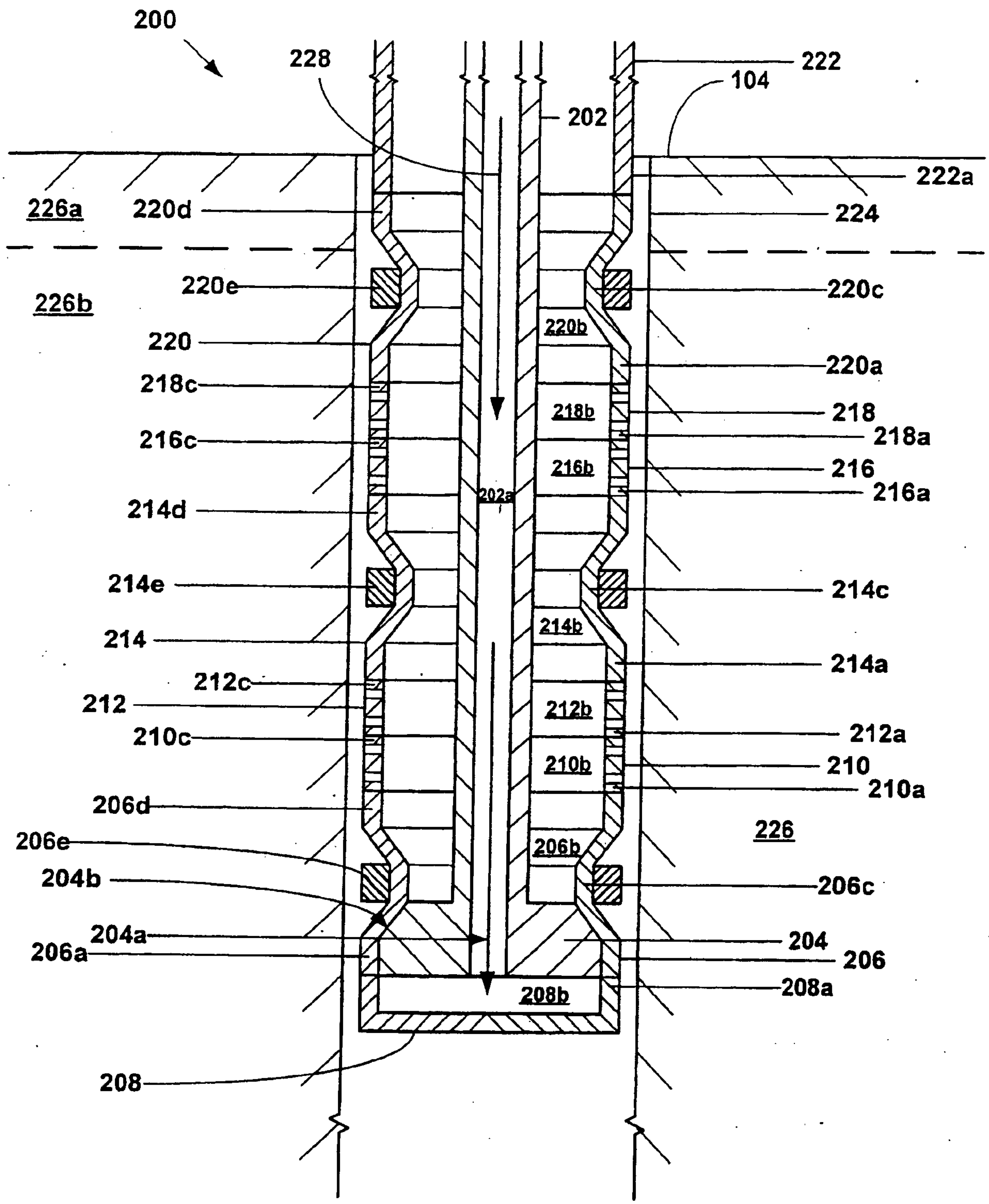
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Fig. 2b

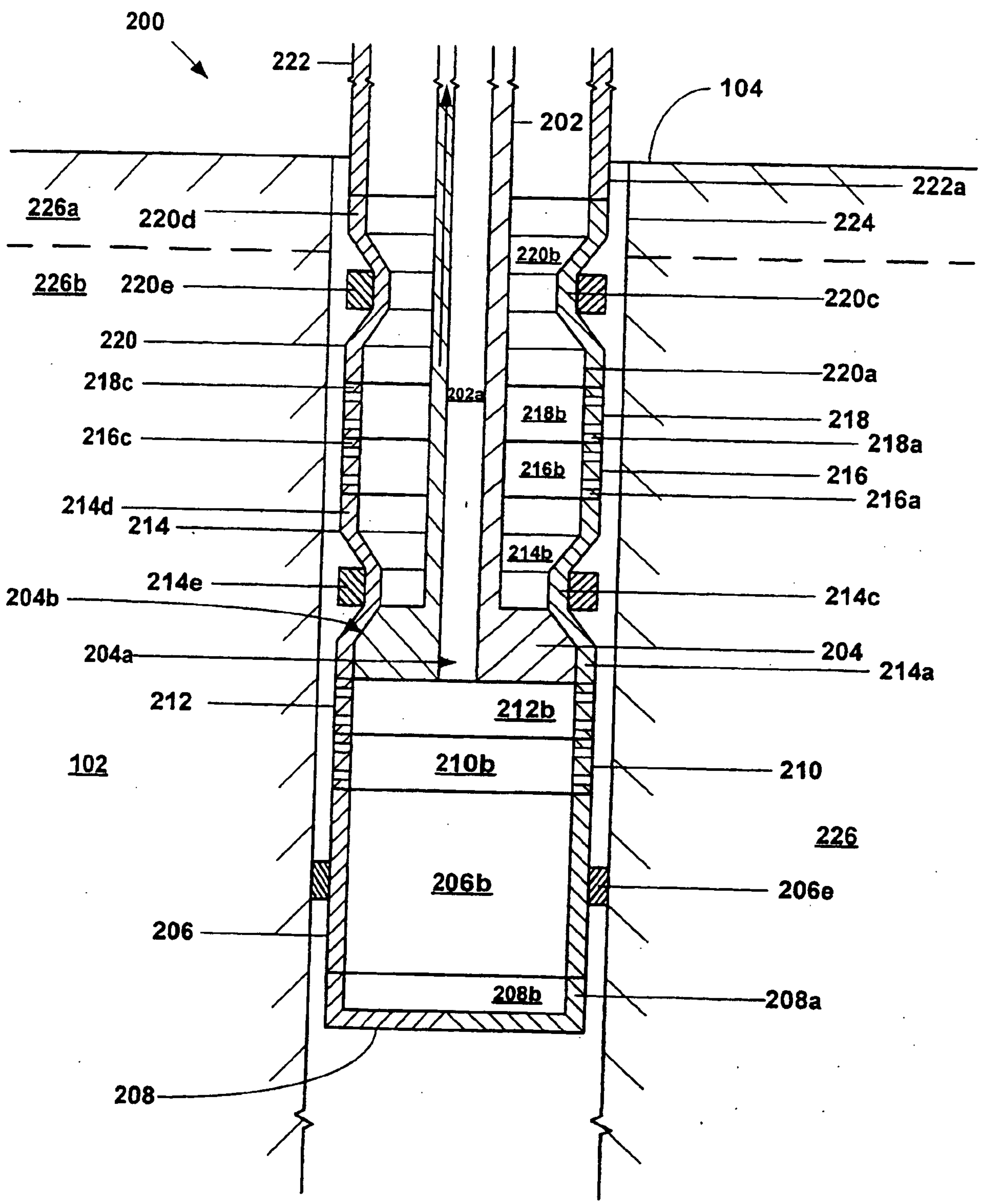
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Fig. 2c

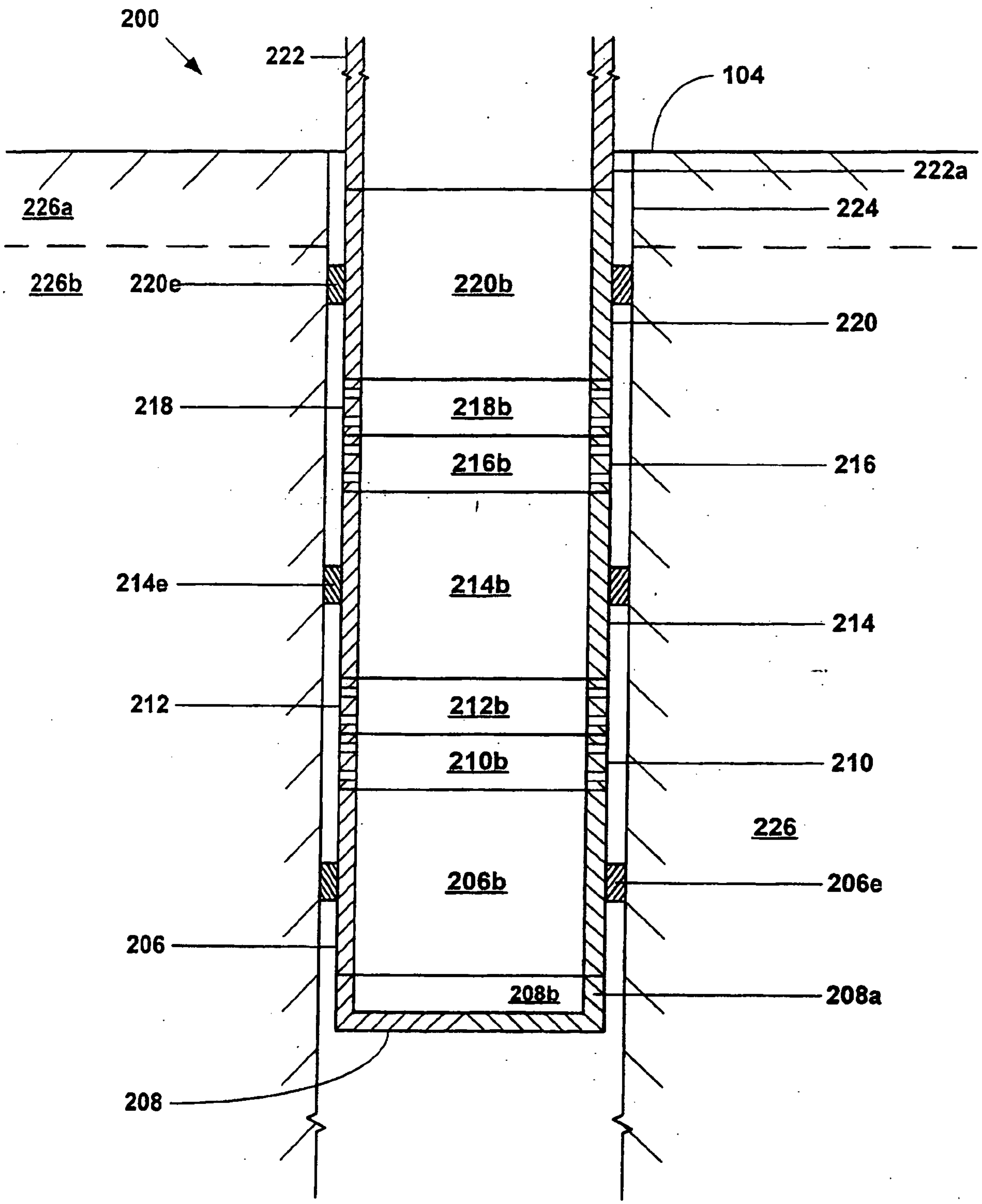
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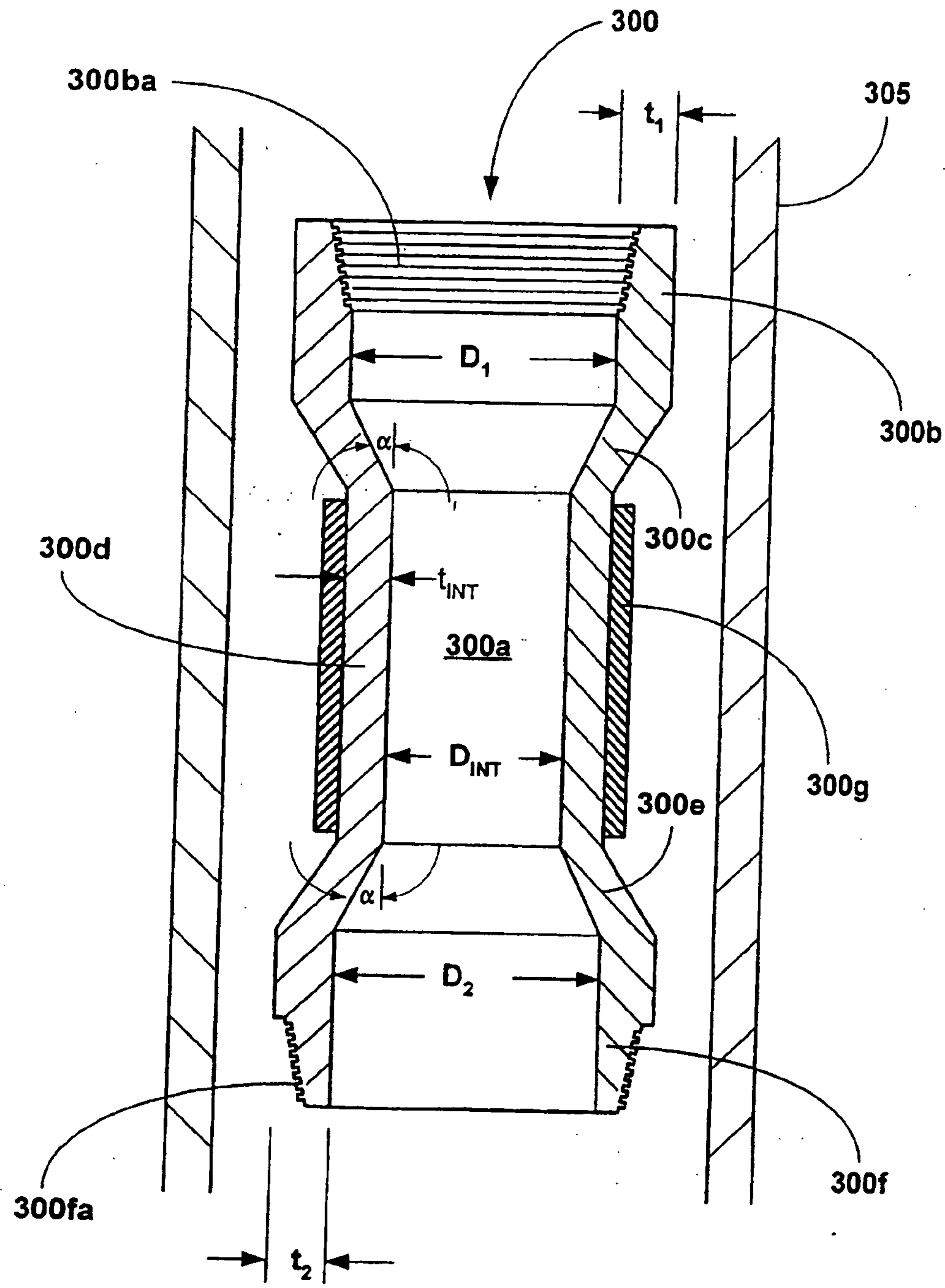
Fig. 2d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D_1
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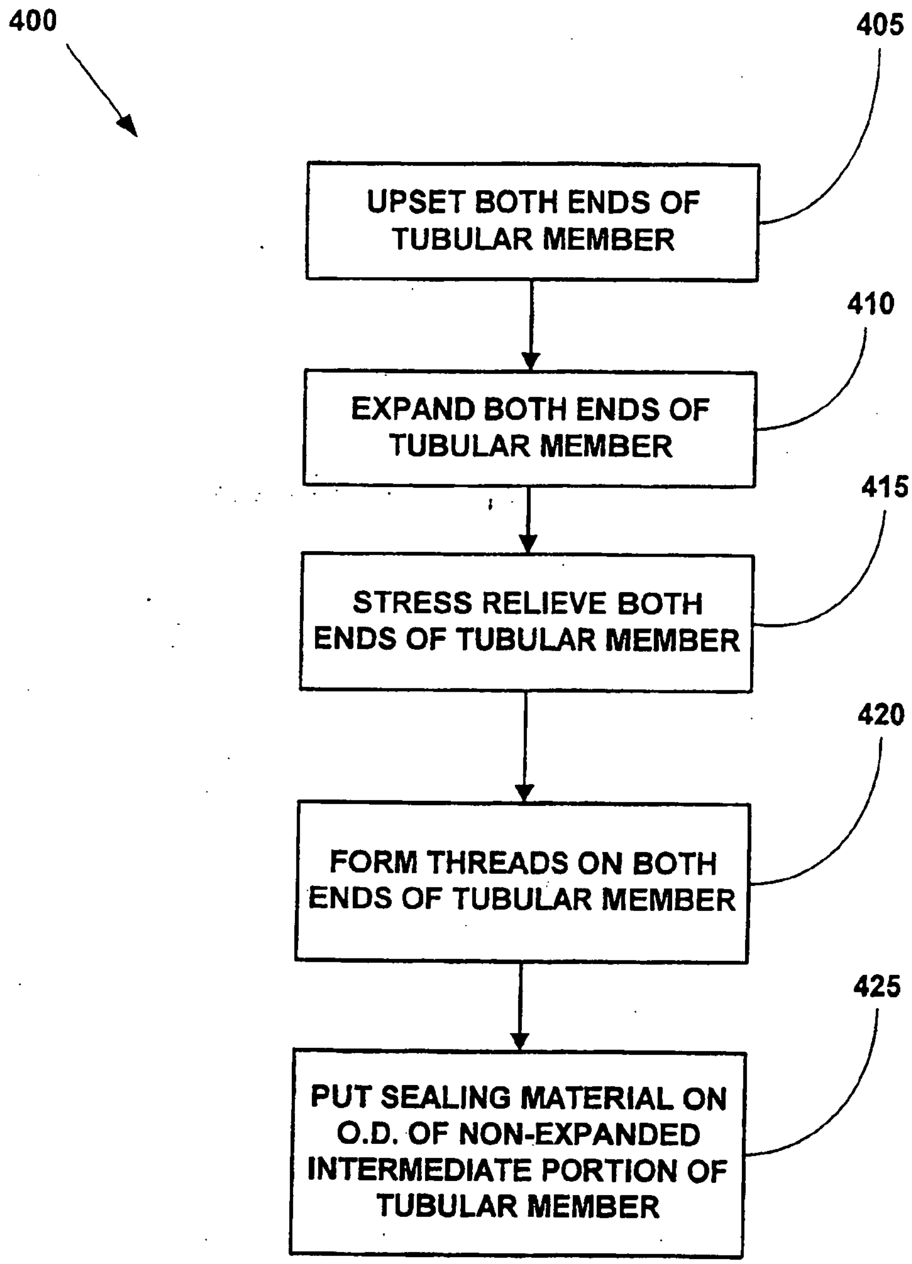
t_2

Fig. 3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405
UPSET BOTH ENDS OF TUBULAR MEMBER
410
EXPAND BOTH ENDS OF TUBULAR MEMBER
415
STRESS RELIEVE BOTH ENDS OF TUBULAR MEMBER
420
FORM THREADS ON BOTH ENDS OF TUBULAR MEMBER
425
PUT SEALING MATERIAL ON O.D. OF NON-EXPANDED INTERMEDIATE PORTION OF TUBULAR MEMBER

Fig. 4

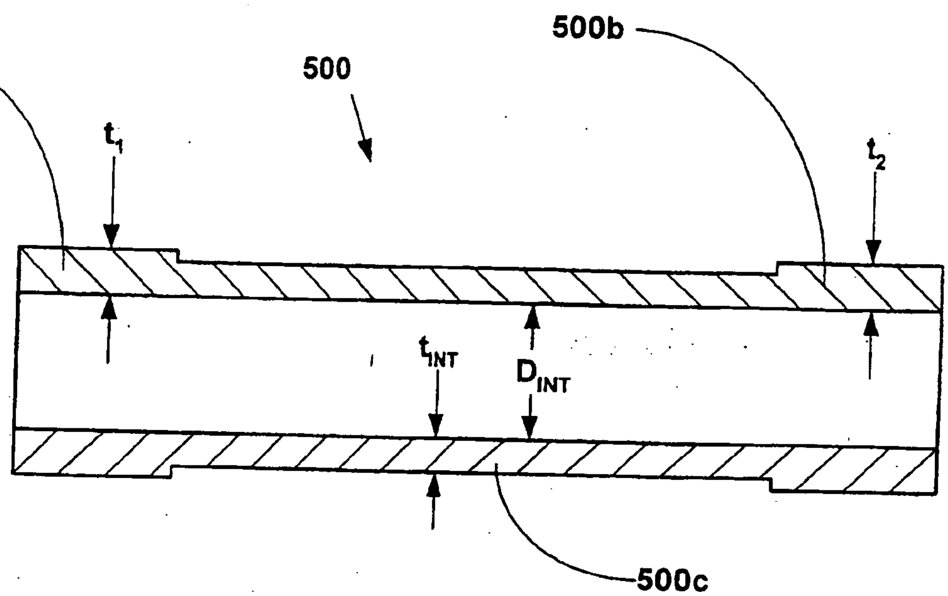
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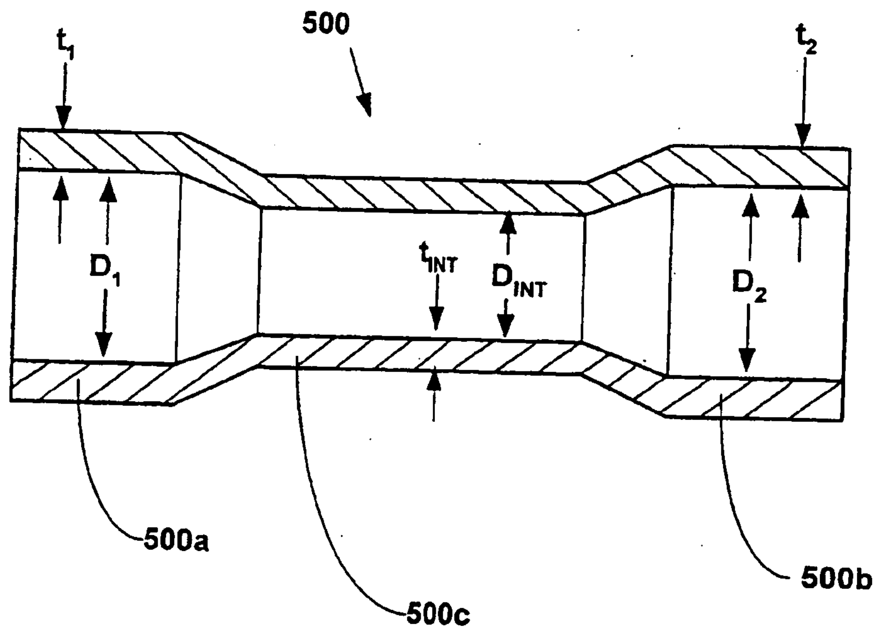
Fig. 5a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D_2
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Fig. 5b

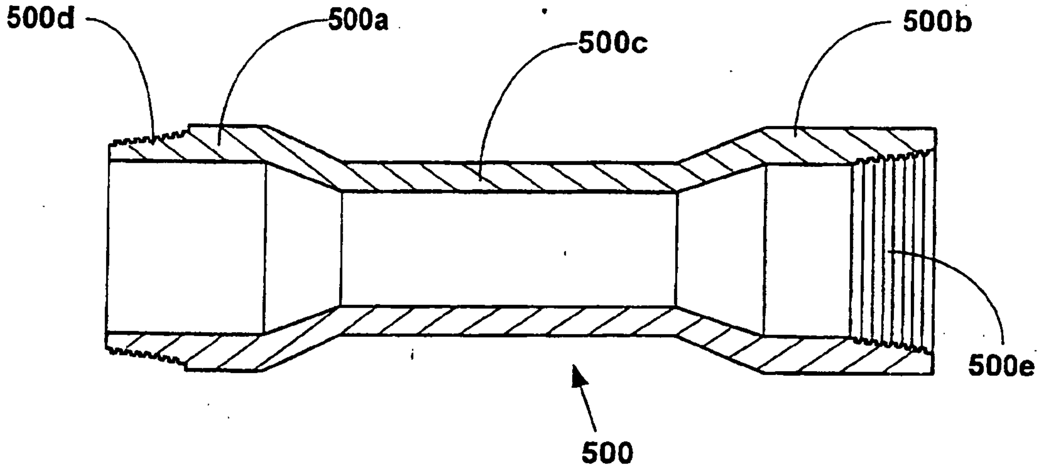
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Fig. 5c

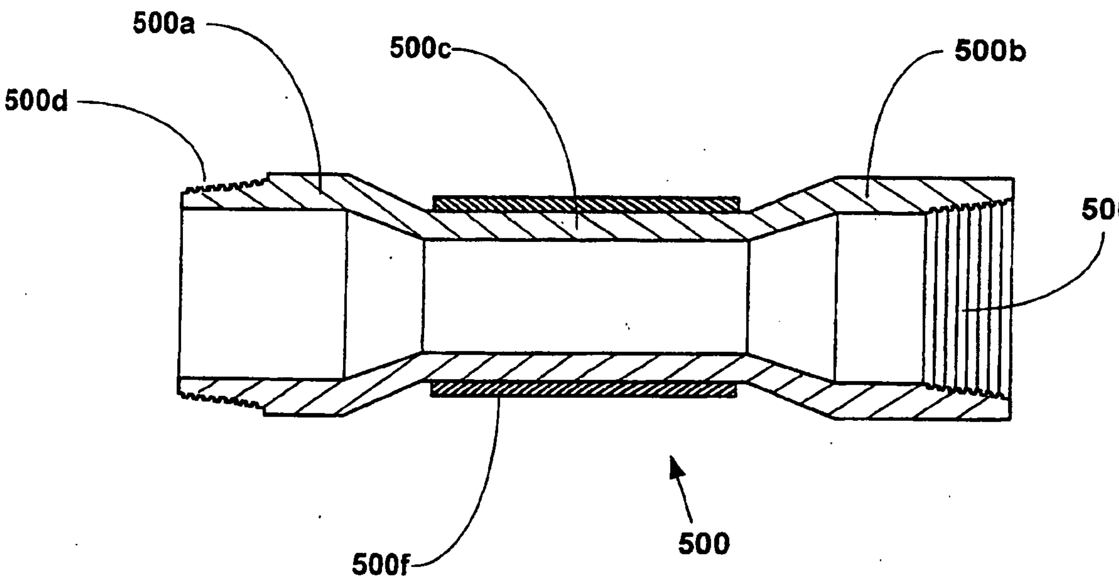
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Fig. 5d

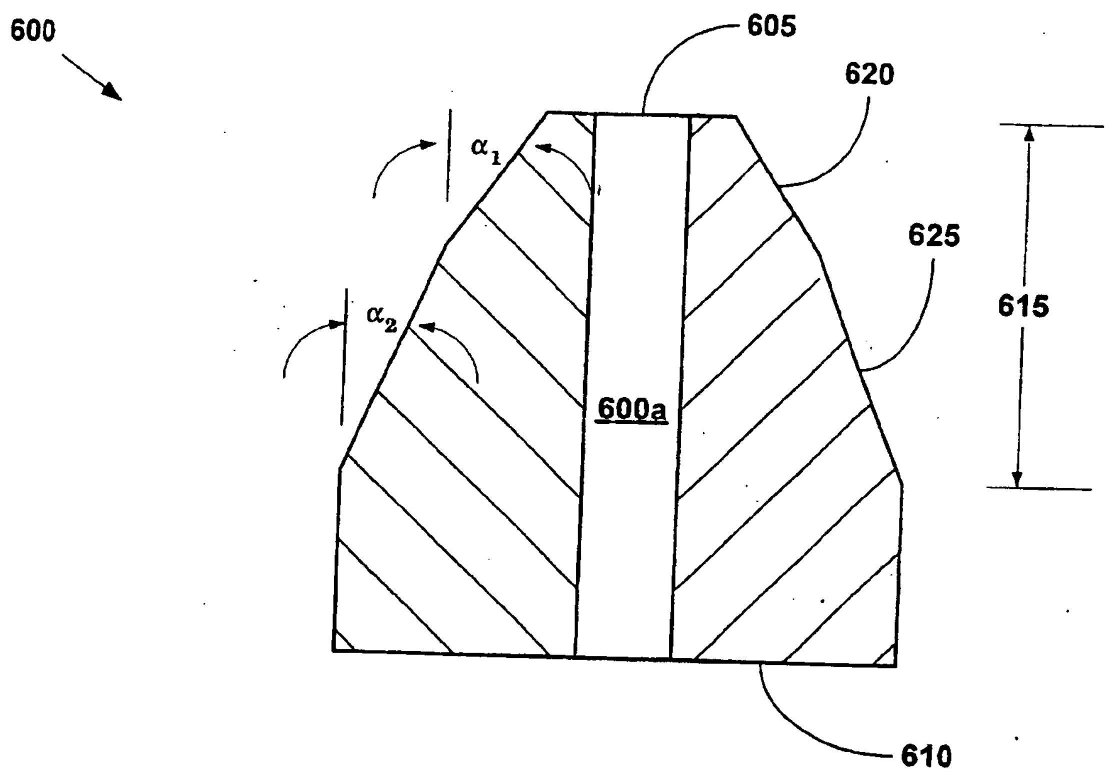


Fig. 6

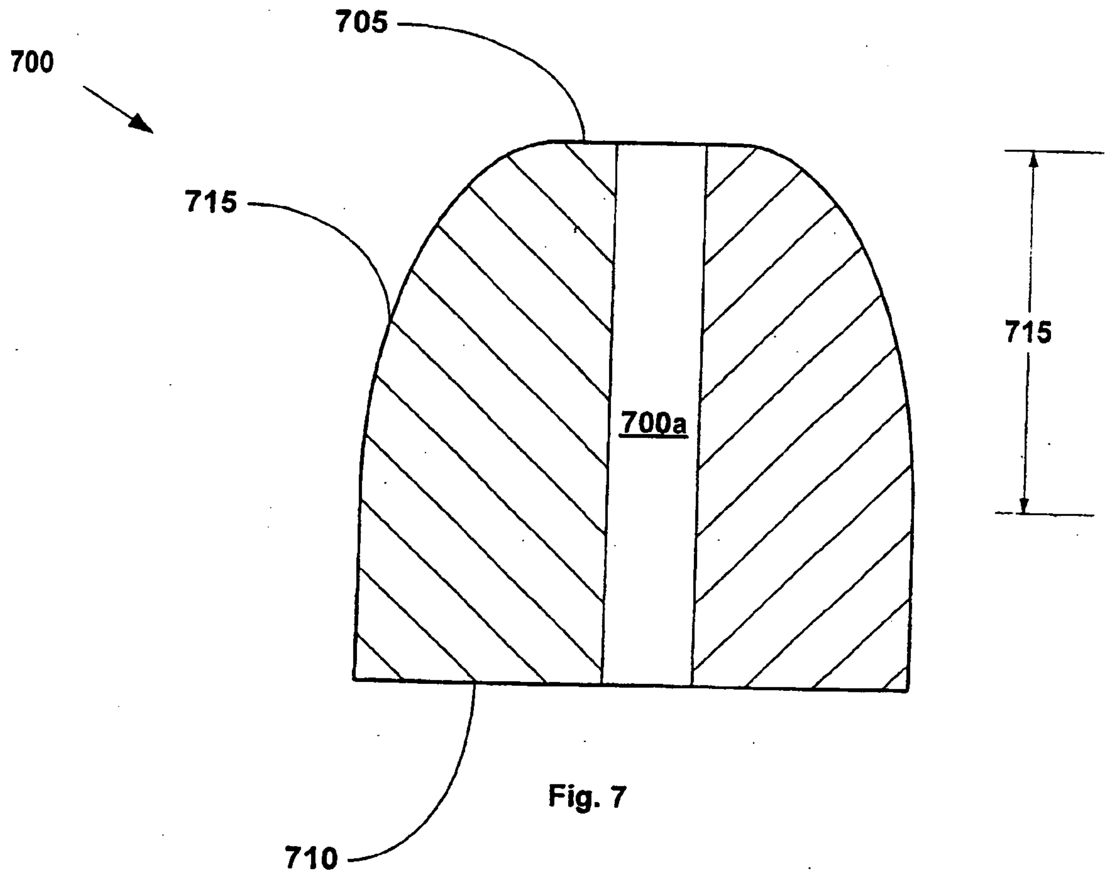
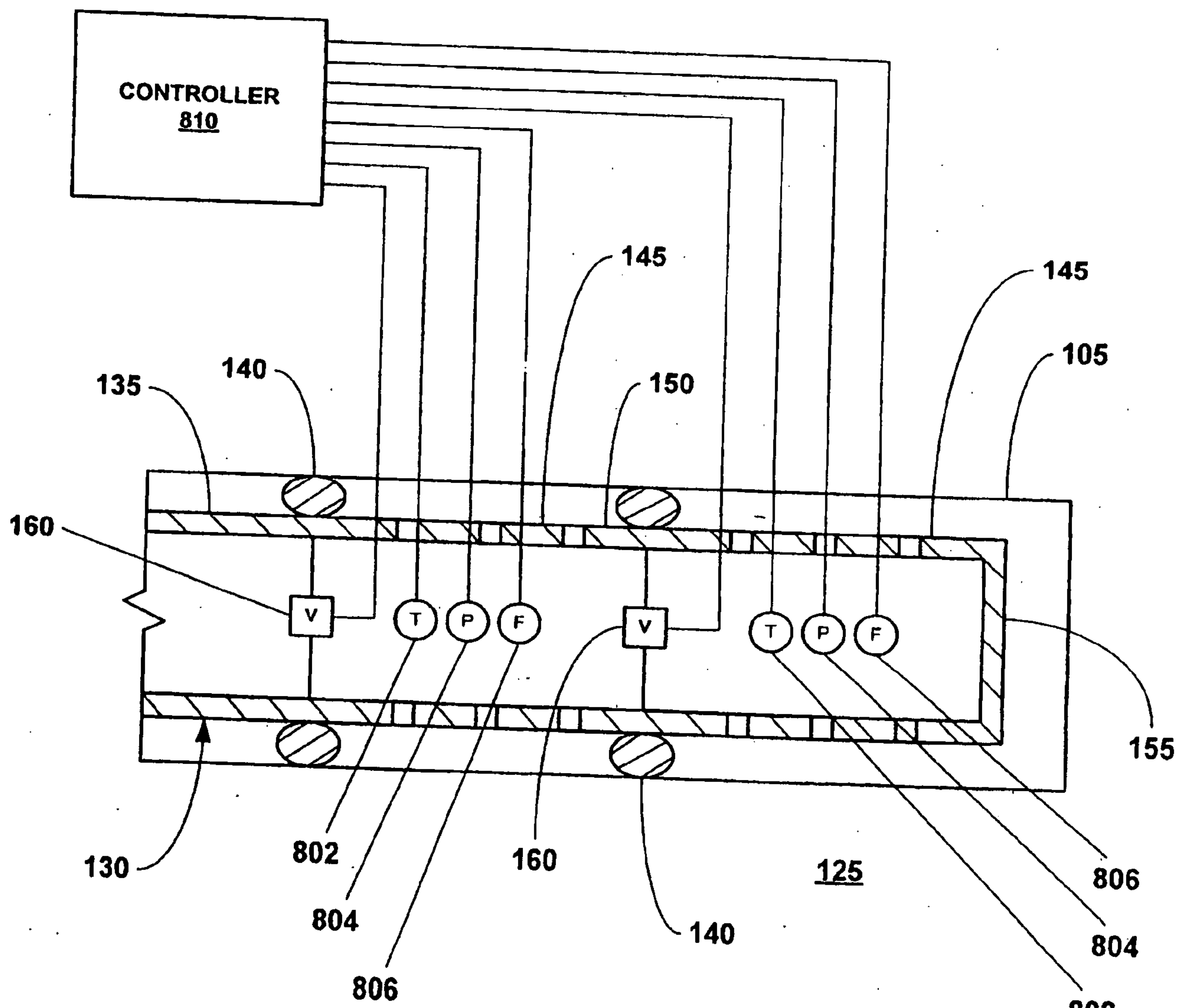


Fig. 7

12/19



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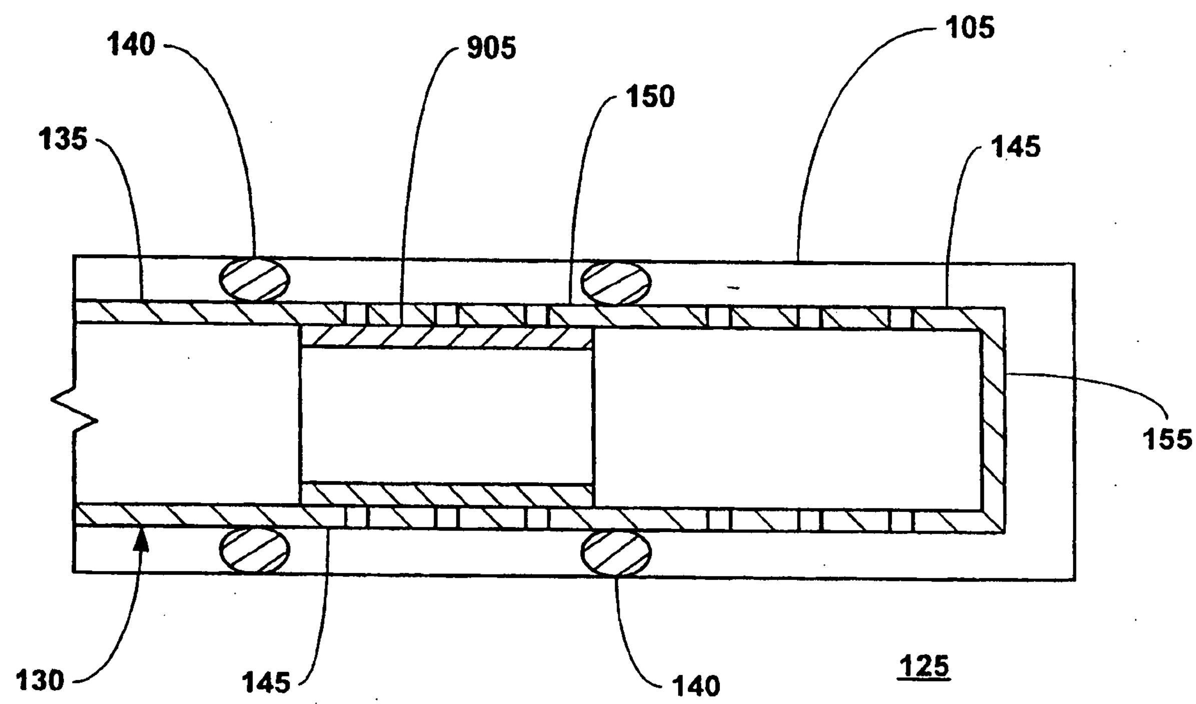

FIGURE 9

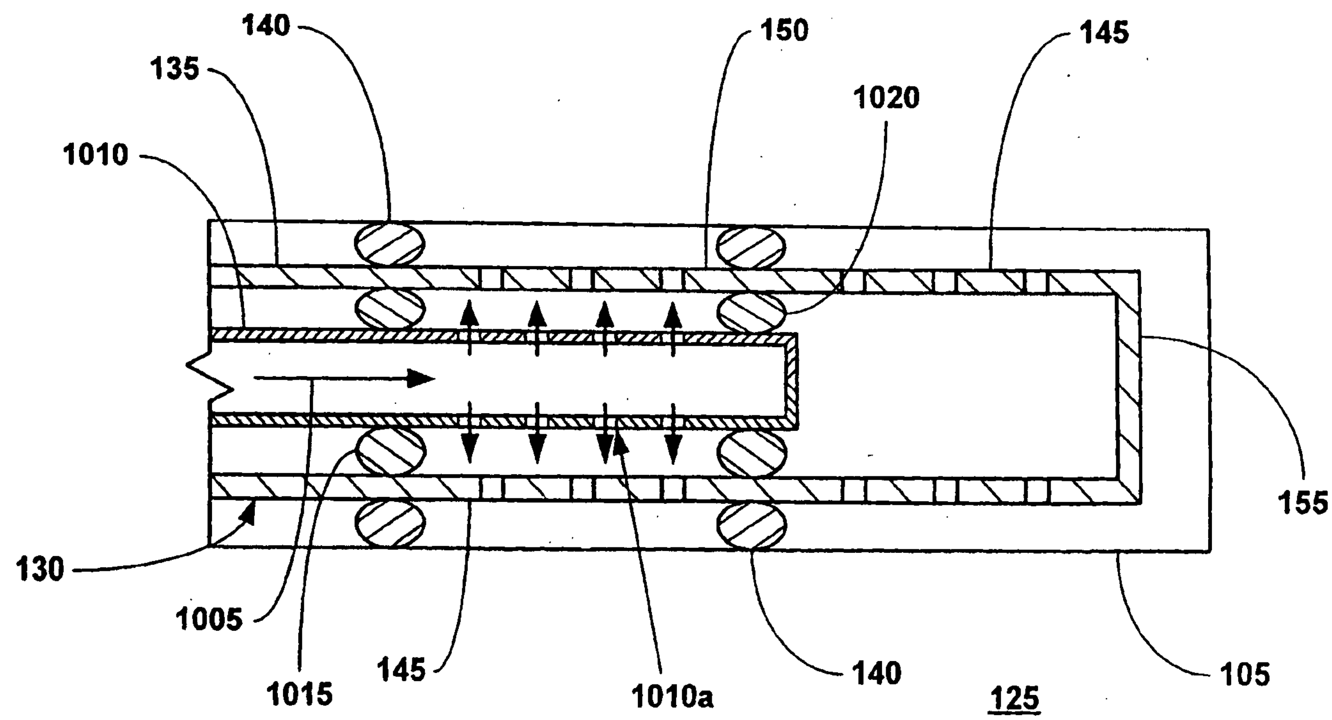
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FIGURE 10

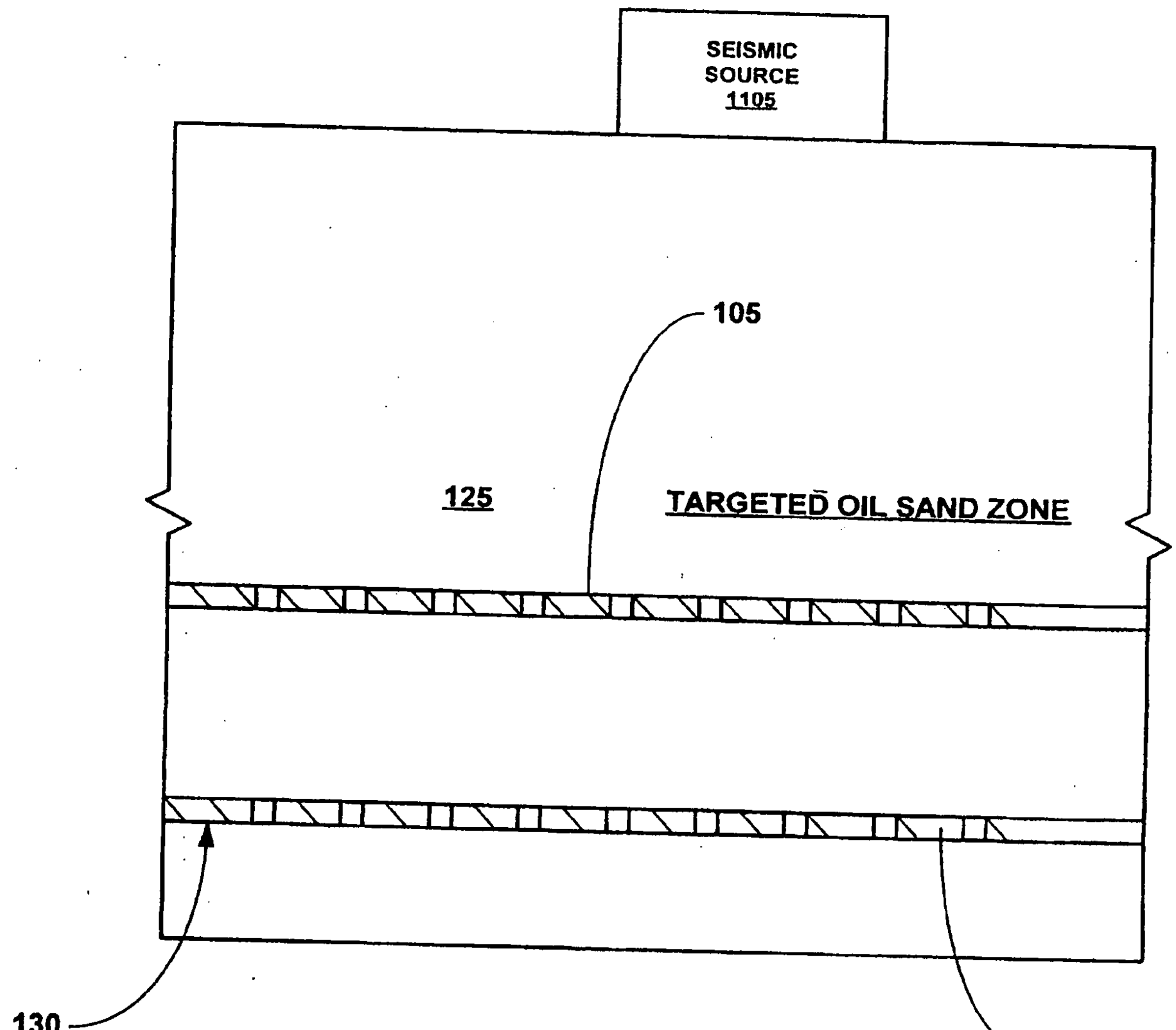

FIGURE 11

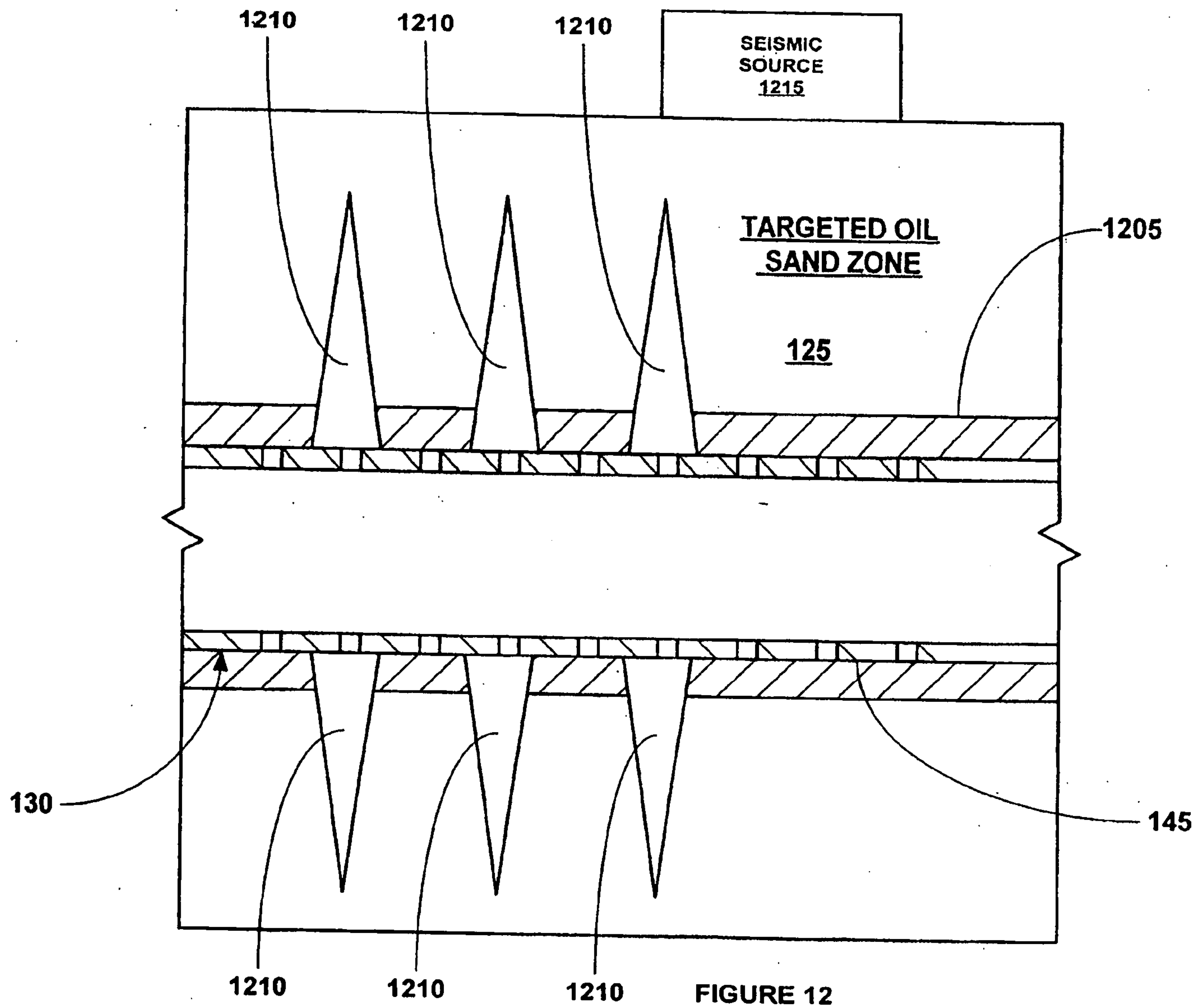
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FIGURE 12

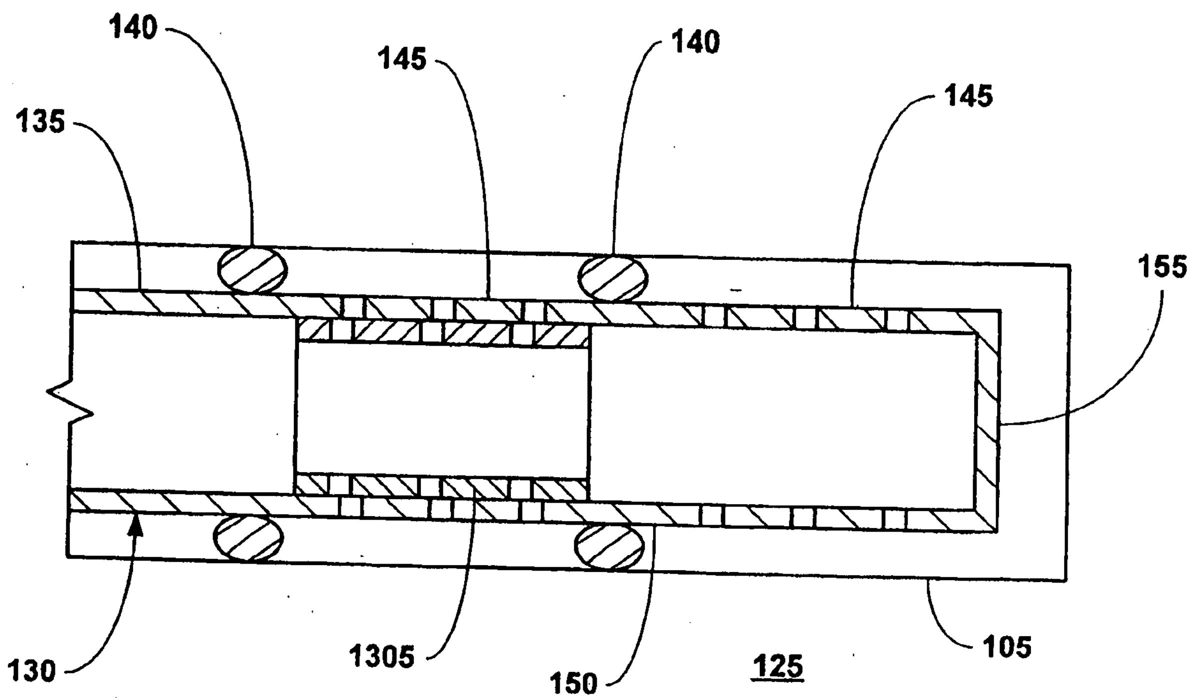


FIGURE 13

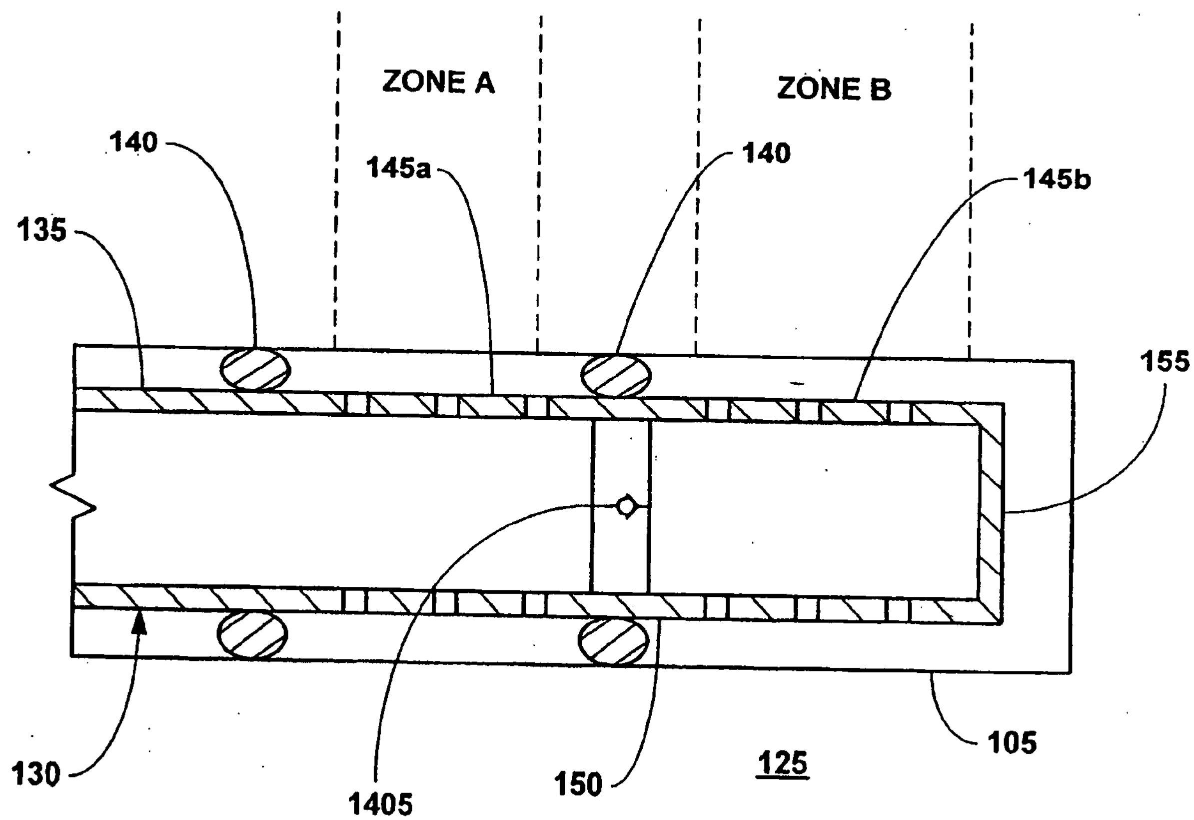
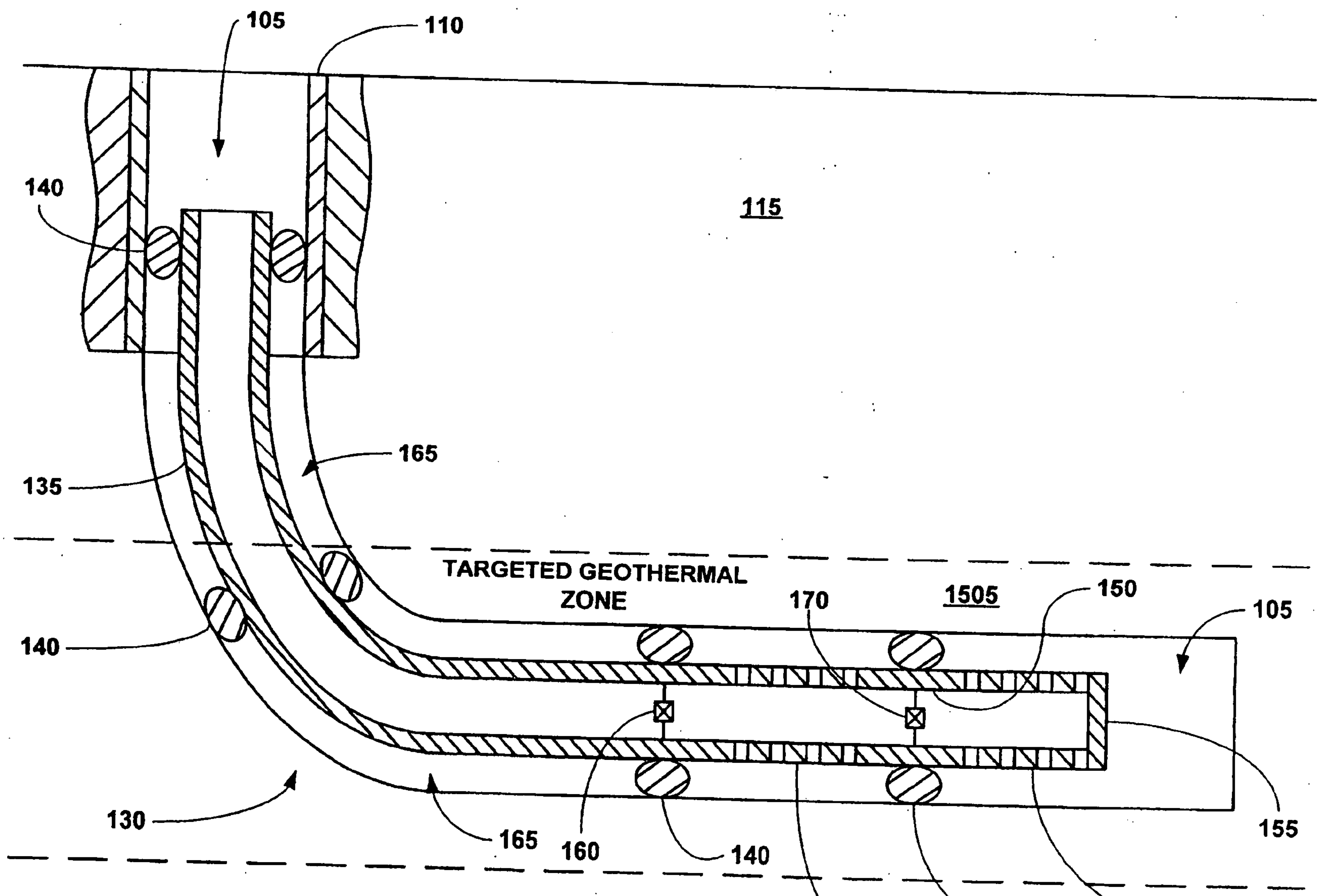


FIGURE 14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ZONE
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145

FIGURE 15

2413136

ISOLATION OF SUBTERRANEAN ZONES

Cross Reference To Related Applications

This application is a continuation-in-part of U.S. patent application serial number 09/969,922, attorney docket number 25791.69, filed on 10/3/2001, that was a continuation-in-part of U.S. patent application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/1999, that issued as U.S. Patent No. 6,328,113, that claimed the benefit of the filing date of U.S. provisional patent application serial number 60/108,558, attorney docket number 25791.9, filed on 11/16/1998, the disclosures of which are incorporated herein by reference.

The present application is related to the following: (1) U.S. patent application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, (2) U.S. patent application serial no. 09/510,913, attorney docket no. 25791.7.02, filed on 2/23/2000, (3) U.S. patent application serial no. 09/502,350, attorney docket no. 25791.8.02, filed on 2/10/2000, (4) U.S. patent application serial no. 09/440,338, attorney docket no. 25791.9.02, filed on 11/15/1999, (5) U.S. patent application serial no. 09/523,460, attorney docket no. 25791.11.02, filed on 3/10/2000, (6) U.S. patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, (7) U.S. patent application serial no. 09/511,941, attorney docket no. 25791.16.02, filed on 2/24/2000, (8) U.S. patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, (9) U.S. patent application serial no. 09/559,122, attorney docket no. 25791.23.02, filed on 4/26/2000, (10) PCT patent application serial no. PCT/US00/18635, attorney docket no. 25791.25.02, filed on 7/9/2000, (11) U.S. provisional patent application serial no. 60/162,671, attorney docket no. 25791.27, filed on 11/1/1999, (12) U.S. provisional patent application serial no. 60/154,047, attorney docket no. 25791.29, filed on 9/16/1999, (13) U.S. provisional patent application serial no. 60/159,082, attorney docket no. 25791.34, filed on 10/12/1999, (14) U.S. provisional patent application serial no. 60/159,039, attorney docket no. 25791.36, filed on 10/12/1999, (15) U.S. provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (16) U.S. provisional patent application serial no. 60/212,359, attorney docket no. 25791.38, filed on 6/19/2000, (17) U.S. provisional patent application serial no. 60/165,228, attorney docket no. 25791.39, filed on 11/12/1999, (18) U.S. provisional patent application serial no. 60/221,443, attorney

docket no. 25791.45, filed on 7/28/2000, (19) U.S. provisional patent application serial no. 60/221,645, attorney docket no. 25791.46, filed on 7/28/2000, (20) U.S. provisional patent application serial no. 60/233,638, attorney docket no. 25791.47, filed on 9/18/2000, (21) U.S. provisional patent application serial no. 60/237,334, attorney docket no. 25791.48, filed on 10/2/2000, (22) U.S. provisional patent application serial no. 60/270,007, attorney docket no. 25791.50, filed on 2/20/2001; (23) U.S. provisional patent application serial no. 60/262,434, attorney docket no. 25791.51, filed on 1/17/2001; (24) U.S, provisional patent application serial no. 60/259,486, attorney docket no. 25791.52, filed on 1/3/2001; (25) U.S. provisional patent application serial no. 60/303,740, attorney docket no. 25791.61, filed on 7/6/2001; (26) U.S. provisional patent application serial no. 60/313,453, attorney docket no. 25791.59, filed on 8/20/2001; (27) U.S. provisional patent application serial no. 60/317,985, attorney docket no. 25791.67, filed on 9/6/2001; (28) U.S. provisional patent application serial no. 60/3318,386, attorney docket no. 25791.67.02, filed on 9/10/2001; and (29) U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, the disclosures of which are incorporated herein by reference.

Background of the Invention

This invention relates generally to oil and gas exploration, and in particular to isolating certain subterranean zones to facilitate oil and gas exploration.

During oil exploration, a wellbore typically traverses a number of zones within a subterranean formation. Some of these subterranean zones will produce oil and gas, while others will not. Further, it is often necessary to isolate subterranean zones from one another in order to facilitate the exploration for and production of oil and gas. Existing methods for isolating subterranean production zones in order to facilitate the exploration for and production of oil and gas are complex and expensive.

The present invention is directed to overcoming one or more of the limitations of the existing processes for isolating subterranean zones during oil and gas exploration.

Summary of the Invention

According to one aspect of the present invention, an apparatus is provided that includes a zonal isolation assembly including: one or more solid tubular members, each

solid tubular member including one or more external seals, one or more perforated tubular members coupled to the solid tubular members, one or more flow control valves operably coupled to the perforated tubular members for controlling the flow of fluidic materials through the perforated tubular members, one or more temperature sensors operably coupled to one or more of the perforated tubular members for monitoring the operating temperature within the perforated tubular members, one or more pressure sensors operably coupled to one or more of the perforated tubular members for monitoring the operating pressure within the perforated tubular members, and one or more flow sensors operably coupled to one or more of the perforated tubular members for monitoring the operating flow rate within the perforated tubular members, a shoe coupled to the zonal isolation assembly, and a controller operably coupled to the flow control valves, the temperature sensors, the pressure sensors, and the flow sensors for monitoring the temperature, pressure and flow sensors and controlling the operation of the flow control valves. At least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore.

According to another aspect of the present invention, a method of isolating a first subterranean zone from a second subterranean zone in a wellbore is provided that includes positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the second subterranean zone, radially expanding at least one of the primary solid tubulars and perforated tubulars within the wellbore, fluidicly coupling the perforated tubulars and the solid tubulars, preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars, monitoring the operating temperatures, pressures, and flow rates within one or more of the perforated tubulars, and controlling the flow of fluidic materials through the perforated tubulars as a function of the monitored operating temperatures, pressures, and flow rates.

According to another aspect of the present invention, a method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, is provided that includes positioning one or more solid tubulars

within the wellbore, positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the producing subterranean zone, radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, fluidicly coupling the solid tubulars with the casing, fluidicly coupling the perforated tubulars with the solid tubulars, fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, monitoring the operating temperatures, pressures, and flow rates within one or more of the perforated tubulars, and controlling the flow of fluidic materials through the perforated tubulars as a function of the monitored operating temperatures, pressures, and flow rates.

According to another aspect of the present invention, a system for isolating a first subterranean zone from a second subterranean zone in a wellbore is provided that includes means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, means for positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the second subterranean zone, means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, means for fluidicly coupling the perforated tubulars and the solid tubulars, means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars, means for monitoring the operating temperatures, pressures, and flow rates within one or more of the perforated tubulars, and means for controlling the flow of fluidic materials through the perforated tubulars as a function of the monitored operating temperatures, pressures, and flow rates.

According to another aspect of the present invention, a system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, is provided that includes means for positioning one or more solid tubulars within the wellbore, means for positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the producing subterranean zone, means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, means for fluidicly coupling the solid tubulars with the casing, means for fluidicly coupling the perforated tubulars with the solid tubulars, means for fluidicly isolating the producing subterranean zone from at least one other

subterranean zone within the wellbore, means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, means for monitoring the operating temperatures, pressures, and flow rates within one or more of the perforated tubulars, and means for controlling the flow of fluidic materials through the perforated tubulars as a function of the monitored operating temperatures, pressures, and flow rates.

According to another aspect of the present invention, an apparatus is provided that includes a zonal isolation assembly including: one or more solid tubular members, each solid tubular member including one or more external seals, one or more perforated tubular members each including radial passages coupled to the solid tubular members, and one or more solid tubular liners coupled to the interior surfaces of one or more of the perforated tubular members for sealing at least some of the radial passages of the perforated tubular members, and a shoe coupled to the zonal isolation assembly. At least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore, and the solid tubular liners are formed by a radial expansion process performed within the wellbore.

According to another aspect of the present invention, a method of isolating a first subterranean zone from a second subterranean zone in a wellbore is provided that includes positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone, radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, fluidicly coupling the perforated tubulars and the primary solid tubulars, preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars, positioning one or more solid tubular liners within the interior of one or more of the perforated tubulars, and radially expanding and plastically deforming the solid tubular liners within the interior of one or more of the perforated tubulars to fluidicly seal at least some of the radial passages of the perforated tubulars.

According to another aspect of the present invention, a method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, is provided that includes positioning one or more solid tubulars within the wellbore, positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zone, radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, fluidicly coupling the solid tubulars with the casing, fluidicly coupling the perforated tubulars with the solid tubulars, fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, positioning one or more solid tubular liners within the interior of one or more of the perforated tubulars, and radially expanding and plastically deforming the solid tubular liners within the interior of one or more of the perforated tubulars to fluidicly seal at least some of the radial passages of the perforated tubulars.

According to another aspect of the present invention, a system for isolating a first subterranean zone from a second subterranean zone in a wellbore is provided that includes means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone, means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, means for fluidicly coupling the perforated tubulars and the solid tubulars, means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars, means for positioning one or more solid tubular liners within the interior of one or more of the perforated tubulars, and means for radially expanding and plastically deforming the solid tubular liners within the interior of one or more of the perforated tubulars to fluidicly seal at least some of the radial passages of the perforated tubulars.

According to another aspect of the present invention, a system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, is provided that includes means for positioning one or more solid

tubulars within the wellbore, means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zone, means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, means for fluidicly coupling the solid tubulars with the casing, means for fluidicly coupling the perforated tubulars with the solid tubulars, means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, means for positioning one or more solid tubular liners within the interior of one or more of the perforated tubulars, and means for radially expanding and plastically deforming the solid tubular liners within the interior of one or more of the perforated tubulars to fluidicly seal at least some of the radial passages of the perforated tubulars.

According to another aspect of the present invention, an apparatus is provided that includes a zonal isolation assembly including: one or more solid tubular members, each solid tubular member including one or more external seals, one or more perforated tubular members each including radial passages coupled to the solid tubular members, and a sealing material coupled to at least some of the perforated tubular members for sealing at least some of the radial passages of the perforated tubular members, and a shoe coupled to the zonal isolation assembly.

According to another aspect of the present invention, a method of isolating a first subterranean zone from a second subterranean zone in a wellbore is provided that includes positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone, radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, fluidicly coupling the perforated tubulars and the primary solid tubulars, preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars, sealing off an annular region within at least one of the perforated tubulars, and injecting a hardenable fluidic sealing material into the sealed annular regions of the perforated tubulars to seal off at least some of the radial passages of the perforated tubulars.

According to another aspect of the present invention, a method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, is provided that includes positioning one or more solid tubulars within the wellbore, positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zone, radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, fluidicly coupling the solid tubulars with the casing, fluidicly coupling the perforated tubulars with the solid tubulars, fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, sealing off an annular region within at least one of the perforated tubulars, and injecting a hardenable fluidic sealing material into the sealed annular regions of the perforated tubulars to seal off at least some of the radial passages of the perforated tubulars.

According to another aspect of the present invention, a system for isolating a first subterranean zone from a second subterranean zone in a wellbore is provided that includes means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone, means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, means for fluidicly coupling the perforated tubulars and the solid tubulars, means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars, means for sealing off an annular region within at least one of the perforated tubulars, and means for injecting a hardenable fluidic sealing material into the sealed annular regions of the perforated tubulars to seal off at least some of the radial passages of the perforated tubulars.

According to another aspect of the present invention, a system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, is provided that includes means for positioning one or more solid

tubulars within the wellbore, means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zone, means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, means for fluidicly coupling the solid tubulars with the casing, means for fluidicly coupling the perforated tubulars with the solid tubulars, means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, means for sealing off an annular region within at least one of the perforated tubulars, and means for injecting a hardenable fluidic sealing material into the sealed annular regions of the perforated tubulars to seal off at least some of the radial passages of the perforated tubulars.

According to another aspect of the present invention, an apparatus is provided that includes a zonal isolation assembly positioned within a wellbore that traverses a subterranean formation including: one or more solid tubular members, each solid tubular member including one or more external seals, one or more perforated tubular members coupled to the solid tubular members, and a shoe coupled to the zonal isolation assembly. At least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore, and at least one of the perforated tubular members are radially expanded into intimate contact with the subterranean formation.

According to another aspect of the present invention, a method of isolating a first subterranean zone from a second subterranean zone in a wellbore is provided that includes positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the second subterranean zone, radially expanding at least one of the primary solid tubulars and perforated tubulars within the wellbore, radially expanding at least one of the perforated tubulars into intimate contact with the second subterranean zone, fluidicly coupling the perforated tubulars and the solid tubulars, and preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars.

According to another aspect of the present invention, a method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, is provided that includes positioning one or more solid tubulars within the wellbore, positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the producing subterranean zone, radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, radially expanding at least one of the perforated tubulars into intimate contact with the producing subterranean zone, fluidicly coupling the solid tubulars with the casing, fluidicly coupling the perforated tubulars with the solid tubulars, fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, and fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone.

According to another aspect of the present invention, a system for isolating a first subterranean zone from a second subterranean zone in a wellbore is provided that includes means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, means for positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the second subterranean zone, means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, means for radially expanding at least one of the perforated tubulars into intimate contact with the second subterranean zone, means for fluidicly coupling the perforated tubulars and the solid tubulars, and means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars.

According to another aspect of the present invention, a system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, is provided that includes means for positioning one or more solid tubulars within the wellbore, means for positioning one or more perforated tubulars within the wellbore each including one or more radial openings, the perforated tubulars traversing the producing subterranean zone, means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, means for radially

expanding at least one of the perforated tubulars into intimate contact with the producing subterranean zone, means for fluidicly coupling the solid tubulars with the casing, means for fluidicly coupling the perforated tubulars with the solid tubulars, means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, and means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone.

According to another aspect of the present invention, an apparatus is provided that includes a zonal isolation assembly positioned within a wellbore that traverses a subterranean formation and includes a perforated wellbore casing, including: one or more solid tubular members, each solid tubular member including one or more external seals, one or more perforated tubular members coupled to the solid tubular members, and a shoe coupled to the zonal isolation assembly. At least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore, and at least one of the perforated tubular members are radially expanded into intimate contact with the perforated wellbore casing.

According to another aspect of the present invention, a method of isolating a first subterranean zone from a second subterranean zone in a wellbore that includes a perforated casing that traverses the second subterranean zone, is provided that includes positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the second subterranean zone, radially expanding at least one of the primary solid tubulars and perforated tubulars within the wellbore, radially expanding at least one of the perforated tubulars into intimate contact with the perforated casing, fluidicly coupling the perforated tubulars and the solid tubulars, and preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars.

According to another aspect of the present invention, a method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing and a perforated casing that traverses the producing subterranean

zone, is provided that includes positioning one or more solid tubulars within the wellbore, positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the producing subterranean zone, radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, radially expanding at least one of the perforated tubulars into intimate contact with the perforated casing, fluidicly coupling the solid tubulars with the casing, fluidicly coupling the perforated tubulars with the solid tubulars, fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, and fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone.

According to another aspect of the present invention, a system for isolating a first subterranean zone from a second subterranean zone in a wellbore that includes a perforated casing that traverses the second subterranean zone, is provided that includes means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, means for positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the second subterranean zone, means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, means for radially expanding at least one of the perforated tubulars into intimate contact with the perforated casing, means for fluidicly coupling the perforated tubulars and the solid tubulars, and means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars.

According to another aspect of the present invention, a system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing and a perforated casing that traverses the producing subterranean zone, that includes means for positioning one or more solid tubulars within the wellbore, means for positioning one or more perforated tubulars within the wellbore each including one or more radial openings, the perforated tubulars traversing the producing subterranean zone, means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, means for radially expanding at least one of the perforated tubulars into intimate contact with the perforated casing,

means for fluidicly coupling the solid tubulars with the casing, means for fluidicly coupling the perforated tubulars with the solid tubulars, means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, and means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone.

According to another aspect of the present invention, an apparatus is provided that includes a zonal isolation assembly including: one or more solid tubular members, each solid tubular member including one or more external seals, one or more perforated tubular members each including radial passages coupled to the solid tubular members, and one or more perforated tubular liners each including one or more radial passages coupled to the interior surfaces of one or more of the perforated tubular members, and a shoe coupled to the zonal isolation assembly. At least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore, and the perforated tubular liners are formed by a radial expansion process performed within the wellbore.

According to another aspect of the present invention, a method of isolating a first subterranean zone from a second subterranean zone in a wellbore is provided that includes positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone, radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, fluidicly coupling the perforated tubulars and the primary solid tubulars, preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars, positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars, and radially expanding and plastically deforming the perforated tubular liners within the interior of one or more of the perforated tubulars.

According to another aspect of the present invention, a method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, is provided that includes positioning one or more solid tubulars

within the wellbore, positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zone, radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, fluidicly coupling the solid tubulars with the casing, fluidicly coupling the perforated tubulars with the solid tubulars, fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars, and radially expanding and plastically deforming the perforated tubular liners within the interior of one or more of the perforated tubulars.

According to another aspect of the present invention, a system for isolating a first subterranean zone from a second subterranean zone in a wellbore is provided that includes means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone, means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, means for fluidicly coupling the perforated tubulars and the solid tubulars, means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars, means for positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars, and means for radially expanding and plastically deforming the perforated tubular liners within the interior of one or more of the perforated tubulars.

According to another aspect of the present invention, a system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, is provided that includes means for positioning one or more solid tubulars within the wellbore, means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zone, means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, means for fluidicly

coupling the solid tubulars with the casing, means for fluidicly coupling the perforated tubulars with the solid tubulars, means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, means for positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars, and means for radially expanding and plastically deforming the perforated tubular liners within the interior of one or more of the perforated tubulars.

According to another aspect of the present invention, an apparatus is provided that includes a zonal isolation assembly including: one or more solid tubular members, each solid tubular member including one or more external seals, two or more perforated tubular members each including radial passages coupled to the solid tubular members, and one or more one-way valves for controllably fluidicly coupling the perforated tubular members, and a shoe coupled to the zonal isolation assembly. At least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore.

According to another aspect of the present invention, a method of isolating a first subterranean zone from a second subterranean zone having a plurality of producing zones in a wellbore is provided that includes positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, positioning two or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone, radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, fluidicly coupling the perforated tubulars and the primary solid tubulars, preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars, and preventing fluids from passing from one of the producing zones that has not been depleted to one of the producing zones that has been depleted.

According to another aspect of the present invention, a method of extracting materials from a wellbore having a plurality of producing subterranean zones, at least a portion of the wellbore including a casing, is provided that includes positioning one or more solid

tubulars within the wellbore, positioning two or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zones, radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, fluidicly coupling the solid tubulars with the casing, fluidicly coupling the perforated tubulars with the solid tubulars, fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, preventing fluids from passing from one of the producing zones that has not been depleted to one of the producing zones that has been depleted.

According to another aspect of the present invention, a system for isolating a first subterranean zone from a second subterranean zone having a plurality of producing zones in a wellbore is provided that includes means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone, means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, means for fluidicly coupling the perforated tubulars and the solid tubulars, means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars, means for positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars, and means for preventing fluids from passing from one of the producing zones that has not been depleted to one of the producing zones that has been depleted.

According to another aspect of the present invention, a system for extracting materials from a plurality of producing subterranean zones in a wellbore, at least a portion of the wellbore including a casing, is provided that includes means for positioning one or more solid tubulars within the wellbore, means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zones, means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, means for fluidicly coupling the solid tubulars with the casing, means for fluidicly coupling the

perforated tubulars with the solid tubulars, means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, means for positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars, and means for preventing fluids from passing from one of the producing zones that has not been depleted to one of the producing zones that has been depleted.

According to another aspect of the present invention, an apparatus for extracting geothermal energy from a subterranean formation containing a source of geothermal energy is provided that includes a zonal isolation assembly positioned within the subterranean formation including: one or more solid tubular members, each solid tubular member including one or more external seals, one or more perforated tubular members each including radial passages coupled to the solid tubular members, and one or more perforated tubular liners each including one or more radial passages coupled to the interior surfaces of one or more of the perforated tubular members, and a shoe coupled to the zonal isolation assembly. At least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore.

According to another aspect of the present invention, a method of isolating a first subterranean zone from a second subterranean zone including a source of geothermal energy in a wellbore is provided that includes positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone, radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, fluidicly coupling the perforated tubulars and the primary solid tubulars, preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars, positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars, and radially expanding and plastically deforming the perforated tubular liners within the interior of one or more of the perforated tubulars.

According to another aspect of the present invention, a method of extracting geothermal energy from a subterranean geothermal zone in a wellbore, at least a portion of the wellbore including a casing, is provided that includes positioning one or more solid tubulars within the wellbore, positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the subterranean geothermal zone, radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, fluidicly coupling the solid tubulars with the casing, fluidicly coupling the perforated tubulars with the solid tubulars, fluidicly isolating the subterranean geothermal zone from at least one other subterranean zone within the wellbore, and fluidicly coupling at least one of the perforated tubulars with the subterranean geothermal zone.

According to another aspect of the present invention, a system for isolating a first subterranean zone from a second geothermal subterranean zone in a wellbore is provided that includes means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second geothermal subterranean zone, means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, means for fluidicly coupling the perforated tubulars and the solid tubulars, and means for preventing the passage of fluids from the first subterranean zone to the second geothermal subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars.

According to another aspect of the present invention, a system for extracting geothermal energy from a subterranean geothermal zone in a wellbore, at least a portion of the wellbore including a casing, is provided that includes means for positioning one or more solid tubulars within the wellbore, means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the subterranean geothermal zone, means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, means for fluidicly coupling the solid tubulars with the casing, means for fluidicly coupling the perforated tubulars with the solid tubulars, means for fluidicly isolating the subterranean geothermal zone from at least one other

subterranean zone within the wellbore, and means for fluidicly coupling at least one of the perforated tubulars with the subterranean geothermal zone.

According to another aspect of the present invention, an apparatus is provided that includes a zonal isolation assembly including: one or more solid tubular members, each solid tubular member including one or more external seals, one or more perforated tubular members each including one or more radial passages coupled to the solid tubular members, and a shoe coupled to the zonal isolation assembly. At least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore, and the radial passage of at least one of the perforated tubular members are cleaned by further radial expansion of the perforated tubular members within the wellbore.

According to another aspect of the present invention, a method of isolating a first subterranean zone from a second subterranean zone in a wellbore is provided that includes positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the second subterranean zone, radially expanding at least one of the primary solid tubulars and perforated tubulars within the wellbore, fluidicly coupling the perforated tubulars and the solid tubulars, preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars, and cleaning materials from the radial passages of at least one of the perforated tubulars by further radial expansion of the perforated tubulars within the wellbore.

According to another aspect of the present invention, a method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, is provided that includes positioning one or more solid tubulars within the wellbore, positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the producing subterranean zone, radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, fluidicly coupling the solid tubulars with the casing, fluidicly coupling the perforated tubulars with the solid tubulars, fluidicly

isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, monitoring the operating temperatures, pressures, and flow rates within one or more of the perforated tubulars, and cleaning materials from the radial passages of at least one of the perforated tubulars by further radial expansion of the perforated tubulars within the wellbore.

According to another aspect of the present invention, a system for isolating a first subterranean zone from a second subterranean zone in a wellbore is provided that includes means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, means for positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the second subterranean zone, means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, means for fluidicly coupling the perforated tubulars and the solid tubulars, means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars, and means for cleaning materials from the radial passages of at least one of the perforated tubulars by further radial expansion of the perforated tubulars within the wellbore.

According to another aspect of the present invention, a system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, is provided that includes means for positioning one or more solid tubulars within the wellbore, means for positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the producing subterranean zone, means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, means for fluidicly coupling the solid tubulars with the casing, means for fluidicly coupling the perforated tubulars with the solid tubulars, means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, and means for cleaning materials from the radial passages of at least one of the

perforated tubulars by further radial expansion of the perforated tubulars within the wellbore.

Brief Description of the Drawings

FIG. 1 is a fragmentary cross-sectional view illustrating the isolation of subterranean zones.

Fig. 2a is a cross sectional illustration of the placement of an illustrative embodiment of a system for isolating subterranean zones within a borehole.

Fig. 2b is a cross sectional illustration of the system of Fig. 2a during the injection of a fluidic material into the tubular support member.

Fig. 2c is a cross sectional illustration of the system of Fig. 2b while pulling the tubular expansion cone out of the wellbore.

Fig. 2d is a cross sectional illustration of the system of Fig. 2c after the tubular expansion cone has been completely pulled out of the wellbore.

Fig. 3 is a cross sectional illustration of an illustrative embodiment of the expandable tubular members of the system of Fig. 2a.

Fig. 4 is a flow chart illustration of an illustrative embodiment of a method for manufacturing the expandable tubular member of Fig. 3.

Fig. 5a is a cross sectional illustration of an illustrative embodiment of the upsetting of the ends of a tubular member.

Fig. 5b is a cross sectional illustration of the expandable tubular member of Fig. 5a after radially expanding and plastically deforming the ends of the expandable tubular member.

Fig. 5c is a cross sectional illustration of the expandable tubular member of Fig. 5b after forming threaded connections on the ends of the expandable tubular member.

Fig. 5d is a cross sectional illustration of the expandable tubular member of Fig. 5c after coupling sealing members to the exterior surface of the intermediate unexpended portion of the expandable tubular member.

Fig. 6 is a cross-sectional illustration of an exemplary embodiment of a tubular expansion cone.

Fig. 7 is a cross-sectional illustration of an exemplary embodiment of a tubular expansion cone.

Fig. 8 is a fragmentary cross sectional illustration of an alternative embodiment of the system for isolating subterranean zones of Fig. 1.

Fig. 9 is a fragmentary cross sectional illustration of an embodiment of a method for lining one of the perforated tubular members of the system for isolating subterranean zones of Fig. 1 with a solid tubular liner.

Fig. 10 is a fragmentary cross sectional illustration of an embodiment of a method for sealing one of the perforated tubular members of the system for isolating subterranean zones of Fig. 1 with a hardenable fluidic sealing material.

Fig. 11 is a fragmentary cross sectional illustration of an embodiment of a method for coupling one of the perforated tubular members of the system for isolating subterranean zones of Fig. 1 with the surrounding subterranean formation.

Fig. 12 is a fragmentary cross sectional illustration of an embodiment of a method for coupling one of the perforated tubular members of the system for isolating subterranean zones of Fig. 1 with a surrounding perforated wellbore casing.

Fig. 13 is a fragmentary cross sectional illustration of an embodiment of a method for lining one of the perforated tubular members of the system for isolating subterranean zones of Fig. 1 with another perforated tubular member.

Fig. 14 is a fragmentary cross sectional illustration of an alternative embodiment of the system for isolating subterranean zones of Fig. 1 that includes a one-way valve for preventing flow from a producing zone into a depleted zone.

Fig. 15 is a fragmentary cross sectional illustration of an alternative embodiment of the system for isolating subterranean zones of Fig. 1 in which the system is used to extract geothermal energy from a subterranean geothermal zone.

Detailed Description of the Illustrative Embodiments

An apparatus and method for isolating one or more subterranean zones from one or more other subterranean zones is provided. The apparatus and method permits a producing zone to be isolated from a nonproducing zone using a combination of solid and slotted tubulars. In the production mode, the teachings of the present disclosure may be used in combination with conventional, well known, production completion equipment and methods using a series of packers, solid tubing, perforated tubing, and sliding sleeves, which will be inserted into the disclosed apparatus to permit the commingling and/or isolation of the subterranean zones from each other.

Referring to Fig. 1, a wellbore 105 including a casing 110 are positioned in a subterranean formation 115. The subterranean formation 115 includes a number of productive and non-productive zones, including a water zone 120 and a targeted oil sand zone 125. During exploration of the subterranean formation 115, the wellbore 105 may be extended in a well known manner to traverse the various productive and non-productive zones, including the water zone 120 and the targeted oil sand zone 125.

In a preferred embodiment, in order to fluidicly isolate the water zone 120 from the targeted oil sand zone 125, an apparatus 130 is provided that includes one or more sections of solid casing 135, one or more external seals 140, one or more sections of perforated casing 145, one or more intermediate sections of solid casing 150, and a solid shoe 155. In several exemplary embodiments, the perforated casing 145 includes one or more radial passages.

The solid casing 135 provides a fluid conduit that transmits fluids and other materials from one end of the solid casing 135 to the other end of the solid casing 135. The solid casing 135 may comprise any number of conventional commercially available sections of solid tubular casing such as, for example, oilfield tubulars fabricated from chromium steel or fiberglass. In a preferred embodiment, the solid casing 135 comprises oilfield tubulars available from various foreign and domestic steel mills.

The solid casing 135 is preferably coupled to the casing 110. The solid casing 135 may be coupled to the casing 110 using any number of conventional commercially available processes such as, for example, welding, slotted and expandable connectors, or expandable solid connectors. In a preferred embodiment, the solid casing 135 is coupled to the casing 110 by using expandable solid connectors. The solid casing 135 may comprise a plurality of such solid casing 135.

The solid casing 135 is preferably coupled to one more of the perforated casings 145. The solid casing 135 may be coupled to the perforated casing 145 using any number of conventional commercially available processes such as, for example, welding, or slotted and expandable connectors. In a preferred embodiment, the solid casing 135 is coupled to the perforated casing 145 by expandable solid connectors.

In a preferred embodiment, the casing 135 includes one more valve members 160 for controlling the flow of fluids and other materials within the interior region of the casing 135. In an alternative embodiment, during the production mode of operation, an internal tubular string with various arrangements of packers, perforated tubing, sliding sleeves, and valves may be employed within the apparatus to provide various options for commingling and isolating subterranean zones from each other while providing a fluid path to the surface.

In a particularly preferred embodiment, the casing 135 is placed into the wellbore 105 by expanding the casing 135 in the radial direction into intimate contact with the interior walls of the wellbore 105. The casing 135 may be expanded in the radial direction using any number of conventional commercially available methods.

The seals 140 prevent the passage of fluids and other materials within the annular region 165 between the solid casings 135 and 150 and the wellbore 105. The seals 140 may comprise any number of conventional commercially available sealing materials suitable for sealing a casing in a wellbore such as, for example, lead, rubber or epoxy. In a preferred embodiment, the seals 140 comprise Stratalok epoxy material available from Halliburton Energy Services. The perforated casing 145 permits fluids and other materials to pass into and out of the interior of the perforated casing 145 from and to the annular region 165. In this manner, oil and gas may be produced from a producing subterranean zone within a subterranean formation. The perforated casing 145 may comprise any number of conventional commercially available sections of slotted tubular casing. In a preferred embodiment, the perforated casing 145 comprises expandable slotted tubular casing available from Petroline in Aberdeen, Scotland. In a particularly preferred embodiment, the perforated casing 145 comprises expandable slotted sandscreen tubular casing available from Petroline in Aberdeen, Scotland.

The perforated casing 145 is preferably coupled to one or more solid casing 135. The perforated casing 145 may be coupled to the solid casing 135 using any number of conventional commercially available processes such as, for example, welding, or slotted or solid expandable connectors. In a preferred embodiment, the perforated casing 145 is coupled to the solid casing 135 by expandable solid connectors.

The perforated casing 145 is preferably coupled to one or more intermediate solid casings 150. The perforated casing 145 may be coupled to the intermediate solid casing 150 using any number of conventional commercially available processes such as, for example, welding or expandable solid or slotted connectors. In a preferred embodiment, the perforated casing 145 is coupled to the intermediate solid casing 150 by expandable solid connectors.

The last perforated casing 145 is preferably coupled to the shoe 155. The last perforated casing 145 may be coupled to the shoe 155 using any number of conventional commercially available processes such as, for example, welding or expandable solid or slotted connectors. In a preferred embodiment, the last perforated casing 145 is coupled to the shoe 155 by an expandable solid connector.

In an alternative embodiment, the shoe 155 is coupled directly to the last one of the intermediate solid casings 150.

In a preferred embodiment, the perforated casings 145 are positioned within the wellbore 105 by expanding the perforated casings 145 in a radial direction into intimate contact with the interior walls of the wellbore 105. The perforated casings 145 may be expanded in a radial direction using any number of conventional commercially available processes.

The intermediate solid casing 150 permits fluids and other materials to pass between adjacent perforated casings 145. The intermediate solid casing 150 may comprise any number of conventional commercially available sections of solid tubular casing such as, for example, oilfield tubulars fabricated from chromium steel or fiberglass. In a preferred embodiment, the intermediate solid casing 150 comprises oilfield tubulars available from foreign and domestic steel mills.

The intermediate solid casing 150 is preferably coupled to one or more sections of the perforated casing 145. The intermediate solid casing 150 may be coupled to the perforated casing 145 using any number of conventional commercially available processes such as, for example, welding, or solid or slotted expandable connectors. In a preferred embodiment, the intermediate solid casing 150 is coupled to the perforated casing 145 by expandable solid connectors. The intermediate solid casing 150 may comprise a plurality of such intermediate solid casing 150.

In a preferred embodiment, the each intermediate solid casing 150 includes one more valve members 170 for controlling the flow of fluids and other materials within the interior region of the intermediate casing 150. In an alternative embodiment, as will be recognized by persons having ordinary skill in the art and the benefit of the present disclosure, during the production mode of operation, an internal tubular string with various arrangements of packers, perforated tubing, sliding sleeves, and valves may be employed within the apparatus to provide various options for commingling and isolating subterranean zones from each other while providing a fluid path to the surface.

In a particularly preferred embodiment, the intermediate casing 150 is placed into the wellbore 105 by expanding the intermediate casing 150 in the radial direction into intimate contact with the interior walls of the wellbore 105. The intermediate casing 150 may be expanded in the radial direction using any number of conventional commercially available methods.

In an alternative embodiment, one or more of the intermediate solid casings 150 may be omitted. In an alternative preferred embodiment, one or more of the perforated casings 145 are provided with one or more seals 140.

The shoe 155 provides a support member for the apparatus 130. In this manner, various production and exploration tools may be supported by the show 150. The shoe 150 may comprise any number of conventional commercially available shoes suitable for use in a wellbore such as, for example, cement filled shoe, or an aluminum or composite shoe. In a preferred embodiment, the shoe 150 comprises an aluminum shoe available from Halliburton. In a preferred embodiment, the shoe 155 is selected to provide sufficient strength in compression and tension to permit the use of high capacity production and exploration tools.

In a particularly preferred embodiment, the apparatus 130 includes a plurality of solid casings 135, a plurality of seals 140, a plurality of perforated casings 145, a plurality of intermediate solid casings 150, and a shoe 155. More generally, the apparatus 130 may comprise one or more solid casings 135, each with one or more valve members 160, n perforated casings 145, n-1 intermediate solid casings 150, each with one or more valve members 170, and a shoe 155.

During operation of the apparatus 130, oil and gas may be controllably produced from the targeted oil sand zone 125 using the perforated casings 145. The oil and gas may then be transported to a surface location using the solid casing 135. The use of intermediate solid casings 150 with valve members 170 permits isolated sections of the zone 125 to be selectively isolated for production. The seals 140 permit the zone 125 to be fluidicly isolated from the zone 120. The seals 140 further permits isolated sections of the zone 125 to be fluidicly isolated from each other. In this manner, the

apparatus 130 permits unwanted and/or non-productive subterranean zones to be fluidicly isolated.

In an alternative embodiment, as will be recognized by persons having ordinary skill in the art and also having the benefit of the present disclosure, during the production mode of operation, an internal tubular string with various arrangements of packers, perforated tubing, sliding sleeves, and valves may be employed within the apparatus to provide various options for commingling and isolating subterranean zones from each other while providing a fluid path to the surface.

In several alternative embodiments, the solid casing 135, the perforated casings 145, the intermediate sections of solid casing 150, and/or the solid shoe 155 are radially expanded and plastically deformed within the wellbore 105 in a conventional manner and/or using one or more of the methods and apparatus disclosed in one or more of the following: (1) U.S. patent application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, (2) U.S. patent application serial no. 09/510,913, attorney docket no. 25791.7.02, filed on 2/23/2000, (3) U.S. patent application serial no. 09/502,350, attorney docket no. 25791.8.02, filed on 2/10/2000, (4) U.S. patent application serial no. 09/440,338, attorney docket no. 25791.9.02, filed on 11/15/1999, (5) U.S. patent application serial no. 09/523,460, attorney docket no. 25791.11.02, filed on 3/10/2000, (6) U.S. patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, (7) U.S. patent application serial no. 09/511,941, attorney docket no. 25791.16.02, filed on 2/24/2000, (8) U.S. patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, (9) U.S. patent application serial no. 09/559,122, attorney docket no. 25791.23.02, filed on 4/26/2000, (10) PCT patent application serial no. PCT/US00/18635, attorney docket no. 25791.25.02, filed on 7/9/2000, (11) U.S. provisional patent application serial no. 60/162,671, attorney docket no. 25791.27, filed on 11/1/1999, (12) U.S. provisional patent application serial no. 60/154,047, attorney docket no. 25791.29, filed on 9/16/1999, (13) U.S. provisional patent application serial no. 60/159,082, attorney docket no. 25791.34, filed on 10/12/1999, (14) U.S. provisional patent application serial no. 60/159,039, attorney docket no. 25791.36, filed on 10/12/1999, (15) U.S. provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (16) U.S. provisional patent application serial no. 60/212,359, attorney

docket no. 25791.38, filed on 6/19/2000, (17) U.S. provisional patent application serial no. 60/165,228, attorney docket no. 25791.39, filed on 11/12/1999, (18) U.S. provisional patent application serial no. 60/221,443, attorney docket no. 25791.45, filed on 7/28/2000, (19) U.S. provisional patent application serial no. 60/221,645, attorney docket no. 25791.46, filed on 7/28/2000, (20) U.S. provisional patent application serial no. 60/233,638, attorney docket no. 25791.47, filed on 9/18/2000, (21) U.S. provisional patent application serial no. 60/237,334, attorney docket no. 25791.48, filed on 10/2/2000, (22) U.S. provisional patent application serial no. 60/270,007, attorney docket no. 25791.50, filed on 2/20/2001; (23) U.S. provisional patent application serial no. 60/262,434, attorney docket no. 25791.51, filed on 1/17/2001; (24) U.S, provisional patent application serial no. 60/259,486, attorney docket no. 25791.52, filed on 1/3/2001; (25) U.S. provisional patent application serial no. 60/303,740, attorney docket no. 25791.61, filed on 7/6/2001; (26) U.S. provisional patent application serial no. 60/313,453, attorney docket no. 25791.59, filed on 8/20/2001; (27) U.S. provisional patent application serial no. 60/317,985, attorney docket no. 25791.67, filed on 9/6/2001; (28) U.S. provisional patent application serial no. 60/318,386, attorney docket no. 25791.67.02, filed on 9/10/2001; and (29) U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, the disclosures of which are incorporated herein by reference. In an exemplary embodiment, the radial clearances between the radially expanded solid casings 135, perforated casings 145, intermediate sections of solid casing 150, and/or the solid shoe 155 and the wellbore 105 are eliminated thereby eliminating the annulus between the solid casings, the perforated casings 145, the intermediate sections of solid casing 150, and/or the solid shoe 155 and the wellbore 105. In this manner, the optional need for filling the annulus with a filler material such as, for example, gravel, may be eliminated.

Referring to Figs. 2a-2d, an illustrative embodiment of a system 200 for isolating subterranean formations includes a tubular support member 202 that defines a passage 202a. A tubular expansion cone 204 that defines a passage 204a is coupled to an end of the tubular support member 202. In an exemplary embodiment, the tubular expansion cone 204 includes a tapered outer surface 204b for reasons to be described.

A pre-expanded end 206a of a first expandable tubular member 206 that defines a passage 206b is adapted to mate with and be supported by the tapered outer surface 204b of the tubular expansion cone 204. The first expandable tubular member 206 further includes an unexpended intermediate portion 206c, another pre-expanded end 206d, and a sealing member 206e coupled to the exterior surface of the unexpended intermediate portion. In an exemplary embodiment, the inside and outside diameters of the pre-expanded ends, 206a and 206d, of the first expandable tubular member 206 are greater than the inside and outside diameters of the unexpended intermediate portion 206c. An end 208a of a shoe 208 is coupled to the pre-expanded end 206a of the first expandable tubular member 206 by a conventional threaded connection

An end 210a of a slotted tubular member 210 that defines a passage 210b is coupled to the other pre-expanded end 206d of the first expandable tubular member 206 by a conventional threaded connection. Another end 210c of the slotted tubular member 210 is coupled to an end 212a of a slotted tubular member 212 that defines a passage 212b by a conventional threaded connection. A pre-expanded end 214a of a second expandable tubular member 214 that defines a passage 214b is coupled to the other end 212c of the tubular member 212. The second expandable tubular member 214 further includes an unexpended intermediate portion 214c, another pre-expanded end 214d, and a sealing member 214e coupled to the exterior surface of the unexpended intermediate portion. In an exemplary embodiment, the inside and outside diameters of the pre-expanded ends, 214a and 214d, of the second expandable tubular member 214 are greater than the inside and outside diameters of the unexpended intermediate portion 214c.

An end 216a of a slotted tubular member 216 that defines a passage 216b is coupled to the other pre-expanded end 214d of the second expandable tubular member 214 by a conventional threaded connection. Another end 216c of the slotted tubular member 216 is coupled to an end 218a of a slotted tubular member 218 that defines a passage 218b by a conventional threaded connection. A pre-expanded end 220a of a third expandable tubular member 220 that defines a passage 220b is coupled to the other end 218c of the slotted tubular member 218. The third expandable tubular member 220 further includes an unexpended intermediate portion 220c, another pre-expanded end 220d, and a sealing member 220e coupled to the exterior surface of the

unexpended intermediate portion. In an exemplary embodiment, the inside and outside diameters of the pre-expanded ends, 220a and 220d, of the third expandable tubular member 220 are greater than the inside and outside diameters of the unexpended intermediate portion 220c.

An end 222a of a tubular member 222 is threadably coupled to the end 30d of the third expandable tubular member 220.

In an exemplary embodiment, the inside and outside diameters of the pre-expanded ends, 206a, 206d, 214a, 214d, 220a and 220d, of the expandable tubular members, 206, 214, and 220, and the slotted tubular members 210, 212, 216, and 218, are substantially equal. In several exemplary embodiments, the sealing members, 206e, 214e, and 220e, of the expandable tubular members, 206, 214, and 220, respectively, further include anchoring elements for engaging the wellbore casing 104. In several exemplary embodiments, the slotted tubular members, 210, 212, 216, and 218, are conventional slotted tubular members having threaded end connections suitable for use in an oil or gas well, an underground pipeline, or as a structural support. In several alternative embodiments, the slotted tubular members, 210, 212, 216, and 218 are conventional slotted tubular members for recovering or introducing fluidic materials such as, for example, oil, gas and/or water from or into a subterranean formation.

In an exemplary embodiment, as illustrated in Fig. 2a, the system 200 is initially positioned in a borehole 224 formed in a subterranean formation 226 that includes a water zone 226a and a targeted oil sand zone 226b. The borehole 224 may be positioned in any orientation from vertical to horizontal. In an exemplary embodiment, the upper end of the tubular support member 202 may be supported in a conventional manner using, for example, a slip joint, or equivalent device in order to permit upward movement of the tubular support member and tubular expansion cone 204 relative to one or more of the expandable tubular members, 206, 214, and 220, and tubular members, 210, 212, 216, and 218.

In an exemplary embodiment, as illustrated in Fig. 2b, a fluidic material 228 is then injected into the system 200, through the passages, 202a and 204a, of the tubular support member 202 and tubular expansion cone 204, respectively.

In an exemplary embodiment, as illustrated in Fig. 2c, the continued injection of the fluidic material 228 through the passages, 202a and 204a, of the tubular support member 202 and the tubular expansion cone 204, respectively, pressurizes the passage 18b of the shoe 18 below the tubular expansion cone thereby radially expanding and plastically deforming the expandable tubular member 206 off of the tapered external surface 204b of the tubular expansion cone 204. In particular, the intermediate non pre-expanded portion 206c of the expandable tubular member 206 is radially expanded and plastically deformed off of the tapered external surface 204b of the tubular expansion cone 204. As a result, the sealing member 206e engages the interior surface of the wellbore casing 104. Consequently, the radially expanded intermediate portion 206c of the expandable tubular member 206 is thereby coupled to the wellbore casing 104. In an exemplary embodiment, the radially expanded intermediate portion 206c of the expandable tubular member 206 is also thereby anchored to the wellbore casing 104.

In an exemplary embodiment, as illustrated in Fig. 2d, after the expandable tubular member 206 has been plastically deformed and radially expanded off of the tapered external surface 204b of the tubular expansion cone 204, the tubular expansion cone is pulled out of the borehole 224 by applying an upward force to the tubular support member 202. As a result, the second and third expandable tubular members, 214 and 220, are radially expanded and plastically deformed off of the tapered external surface 204b of the tubular expansion cone 204. In particular, the intermediate non pre-expanded portion 214c of the second expandable tubular member 214 is radially expanded and plastically deformed off of the tapered external surface 204b of the tubular expansion cone 204. As a result, the sealing member 214e engages the interior surface of the wellbore 224. Consequently, the radially expanded intermediate portion 214c of the second expandable tubular member 214 is thereby coupled to the wellbore 224. In an exemplary embodiment, the radially expanded intermediate portion 214c of the second expandable tubular member 214 is also thereby anchored to the wellbore 104. Furthermore, the continued application of the upward force to the tubular member 202 will then displace the tubular expansion cone 204 upwardly into engagement with the pre-expanded end 220a of the third expandable tubular member 220. Finally, the continued application of the upward force to the tubular member 202

will then radially expand and plastically deform the third expandable tubular member 220 off of the tapered external surface 204b of the tubular expansion cone 204. In particular, the intermediate non pre-expanded portion 220c of the third expandable tubular member 220 is radially expanded and plastically deformed off of the tapered external surface 204b of the tubular expansion cone 204. As a result, the sealing member 220e engages the interior surface of the wellbore 224. Consequently, the radially expanded intermediate portion 220c of the third expandable tubular member 220 is thereby coupled to the wellbore 224. In an exemplary embodiment, the radially expanded intermediate portion 220c of the third expandable tubular member 220 is also thereby anchored to the wellbore 224. As a result, the water zone 226a and fluidicly isolated from the targeted oil sand zone 226b.

After completing the radial expansion and plastic deformation of the third expandable tubular member 220, the tubular support member 202 and the tubular expansion cone 204 are removed from the wellbore 224.

Thus, during the operation of the system 10, the intermediate non pre-expanded portions, 206c, 214c, and 220c, of the expandable tubular members, 206, 214, and 220, respectively, are radially expanded and plastically deformed by the upward displacement of the tubular expansion cone 204. As a result, the sealing members, 206e, 214e, and 220e, are displaced in the radial direction into engagement with the wellbore 224 thereby coupling the shoe 208, the expandable tubular member 206, the slotted tubular members, 210 and 212, the expandable tubular member 214, the slotted tubular members, 216 and 218, and the expandable tubular member 220 to the wellbore. Furthermore, as a result, the connections between the expandable tubular members, 206, 214, and 220, the shoe 208, and the slotted tubular members, 210, 212, 216, and 218, do not have to be expandable connections thereby providing significant cost savings. In addition, the inside diameters of the expandable tubular members, 206, 214, and 220, and the slotted tubular members, 210, 212, 216, and 218, after the radial expansion process, are substantially equal. In this manner, additional conventional tools and other conventional equipment may be easily positioned within, and moved through, the expandable and slotted tubular members. In several alternative embodiments, the conventional tools and equipment include conventional valving and other conventional flow control devices for controlling the flow

of fluidic materials within and between the expandable tubular members, 206, 214, and 220, and the slotted tubular members, 210, 212, 216, and 218.

Furthermore, in the system 200, the slotted tubular members 210, 212, 216, and 218 are interleaved among the expandable tubular members, 206, 214, and 220. As a result, because only the intermediate non pre-expanded portions, 206c, 214c, and 220c, of the expandable tubular members, 206, 214, and 220, respectively, are radially expanded and plastically deformed, the slotted tubular members, 210, 212, 216, and 218 can be conventional slotted tubular members thereby significantly reducing the cost and complexity of the system 10. Moreover, because only the intermediate non pre-expanded portions, 206c, 214c, and 220c, of the expandable tubular members, 206, 214, and 220, respectively, are radially expanded and plastically deformed, the number and length of the interleaved slotted tubular members, 210, 212, 216, and 218 can be much greater than the number and length of the expandable tubular members. In an exemplary embodiment, the total length of the intermediate non pre-expanded portions, 206c, 214c, and 220c, of the expandable tubular members, 206, 214, and 220, is approximately 200 feet, and the total length of the slotted tubular members, 210, 212, 216, and 218, is approximately 3800 feet. Consequently, in an exemplary embodiment, a system 200 having a total length of approximately 4000 feet is coupled to the wellbore 224 by radially expanding and plastically deforming a total length of only approximately 200 feet.

Furthermore, the sealing members 206e, 214e, and 220e, of the expandable tubular members, 206, 214, and 220, respectively, are used to couple the expandable tubular members and the slotted tubular members, 210, 212, 216, and 218 to the wellbore 224, the radial gap between the slotted tubular members, the expandable tubular members, and the wellbore 224 may be large enough to effectively eliminate the possibility of damage to the expandable tubular members and slotted tubular members during the placement of the system 200 within the wellbore.

In an exemplary embodiment, the pre-expanded ends, 206a, 206d, 214a, 214d, 220a, and 220d, of the expandable tubular members, 206, 214, and 220, respectively, and the slotted tubular members, 210, 212, 216, and 218, have outside diameters and wall thicknesses of 8.375 inches and 0.350 inches, respectively; prior to the radial

expansion, the intermediate non pre-expanded portions, 206c, 214c, and 220c, of the expandable tubular members, 206, 214, and 220, respectively, have outside diameters of 7.625 inches; the slotted tubular members, 210, 212, 216, and 218, have inside diameters of 7.675 inches; after the radial expansion, the inside diameters of the intermediate portions, 206c, 214c, and 220c, of the expandable tubular members, 206, 214, and 220, are equal to 7.675 inches; and the wellbore 224 has an inside diameter of 8.755 inches.

In an exemplary embodiment, the pre-expanded ends, 206a, 206d, 214a, 214d, 220a, and 220d, of the expandable tubular members, 206, 214, and 220, respectively, and the slotted tubular members, 210, 212, 216, and 218, have outside diameters and wall thicknesses of 4.500 inches and 0.250 inches, respectively; prior to the radial expansion, the intermediate non pre-expanded portions, 206c, 214c, and 220c, of the expandable tubular members, 206, 214, and 220, respectively, have outside diameters of 4.000 inches; the slotted tubular members, 210, 212, 216, and 218, have inside diameters of 4.000 inches; after the radial expansion, the inside diameters of the intermediate portions, 206c, 214c, and 220c, of the expandable tubular members, 206, 214, and 220, are equal to 4.000 inches; and the wellbore 224 has an inside diameter of 4.892 inches.

In an exemplary embodiment, the system 200 is used to inject or extract fluidic materials such as, for example, oil, gas, and/or water into or from the subterranean formation 226b.

Referring now to Fig. 3, an exemplary embodiment of an expandable tubular member 300 will now be described. The tubular member 300 defines an interior region 300a and includes a first end 300b including a first threaded connection 300ba, a first tapered portion 300c, an intermediate portion 300d, a second tapered portion 300e, and a second end 300f including a second threaded connection 300fa. The tubular member 300 further preferably includes an intermediate sealing member 300g that is coupled to the exterior surface of the intermediate portion 300d.

In an exemplary embodiment, the tubular member 300 has a substantially annular cross section. The tubular member 300 may be fabricated from any number of

conventional commercially available materials such as, for example, Oilfield Country Tubular Goods (OCTG), 13 chromium steel tubing/casing, or L83, J55, or P110 API casing.

In an exemplary embodiment, the interior 300a of the tubular member 300 has a substantially circular cross section. Furthermore, in an exemplary embodiment, the interior region 300a of the tubular member includes a first inside diameter D_1, an intermediate inside diameter D_{INT}, and a second inside diameter D_2. In an exemplary embodiment, the first and second inside diameters, D_1 and D_2, are substantially equal. In an exemplary embodiment, the first and second inside diameters, D_1 and D_2, are greater than the intermediate inside diameter D_{INT}.

The first end 300b of the tubular member 300 is coupled to the intermediate portion 300d by the first tapered portion 300c, and the second end 300f of the tubular member is coupled to the intermediate portion by the second tapered portion 300e. In an exemplary embodiment, the outside diameters of the first and second ends, 300b and 300f, of the tubular member 300 is greater than the outside diameter of the intermediate portion 300d of the tubular member. The first and second ends, 300b and 300f, of the tubular member 300 include wall thicknesses, t_1 and t_2, respectively. In an exemplary embodiment, the outside diameter of the intermediate portion 300d of the tubular member 300 ranges from about 75% to 98% of the outside diameters of the first and second ends, 300a and 300f. The intermediate portion 300d of the tubular member 300 includes a wall thickness t_{INT}.

In an exemplary embodiment, the wall thicknesses t_1 and t_2 are substantially equal in order to provide substantially equal burst strength for the first and second ends, 300a and 300f, of the tubular member 300. In an exemplary embodiment, the wall thicknesses, t_1 and t_2, are both greater than the wall thickness t_{INT} in order to optimally match the burst strength of the first and second ends, 300a and 300f, of the tubular member 300 with the intermediate portion 300d of the tubular member 300.

In an exemplary embodiment, the first and second tapered portions, 300c and 300e, are inclined at an angle, α, relative to the longitudinal direction ranging from about 0 to 30 degrees in order to optimally facilitate the radial expansion of the tubular member

300. In an exemplary embodiment, the first and second tapered portions, 300c and 300e, provide a smooth transition between the first and second ends, 300a and 300f, and the intermediate portion 300d, of the tubular member 300 in order to minimize stress concentrations.

The intermediate sealing member 300g is coupled to the outer surface of the intermediate portion 300d of the tubular member 300. In an exemplary embodiment, the intermediate sealing member 300g seals the interface between the intermediate portion 300d of the tubular member 300 and the interior surface of a wellbore casing 305, or other preexisting structure, after the radial expansion and plastic deformation of the intermediate portion 300d of the tubular member 300. In an exemplary embodiment, the intermediate sealing member 300g has a substantially annular cross section. In an exemplary embodiment, the outside diameter of the intermediate sealing member 300g is selected to be less than the outside diameters of the first and second ends, 300a and 300f, of the tubular member 300 in order to optimally protect the intermediate sealing member 300g during placement of the tubular member 300 within the wellbore casings 305. The intermediate sealing member 300g may be fabricated from any number of conventional commercially available materials such as, for example, thermoset or thermoplastic polymers. In an exemplary embodiment, the intermediate sealing member 300g is fabricated from thermoset polymers in order to optimally seal the radially expanded intermediate portion 300d of the tubular member 300 with the wellbore casing 305. In several alternative embodiments, the sealing member 300g includes one or more rigid anchors for engaging the wellbore casing 305 to thereby anchor the radially expanded and plastically deformed intermediate portion 300d of the tubular member 300 to the wellbore casing.

Referring to Figs. 4, and 5a to 5d, in an exemplary embodiment, the tubular member 300 is formed by a process 400 that includes the steps of: (1) upsetting both ends of a tubular member in step 405; (2) expanding both upset ends of the tubular member in step 410; (3) stress relieving both expanded upset ends of the tubular member in step 415; (4) forming threaded connections in both expanded upset ends of the tubular member in step 420; and (5) putting a sealing material on the outside diameter of the non-expanded intermediate portion of the tubular member in step 425.

As illustrated in FIG. 5a, in step 405, both ends, 500a and 500b, of a tubular member 500 are upset using conventional upsetting methods. The upset ends, 500a and 500b, of the tubular member 500 include the wall thicknesses t_1 and t_2. The intermediate portion 500c of the tubular member 500 includes the wall thickness t_{INT} and the interior diameter D_{INT}. In an exemplary embodiment, the wall thicknesses t_1 and t_2 are substantially equal in order to provide burst strength that is substantially equal along the entire length of the tubular member 500. In an exemplary embodiment, the wall thicknesses t_1 and t_2 are both greater than the wall thickness t_{INT} in order to provide burst strength that is substantially equal along the entire length of the tubular member 500, and also to optimally facilitate the formation of threaded connections in the first and second ends, 500a and 500b.

As illustrated in Fig. 5b, in steps 410 and 415, both ends, 500a and 500b, of the tubular member 500 are radially expanded using conventional radial expansion methods, and then both ends, 500a and 500b, of the tubular member are stress relieved. The radially expanded ends, 500a and 500b, of the tubular member 500 include the interior diameters D_1 and D_2. In an exemplary embodiment, the interior diameters D_1 and D_2 are substantially equal in order to provide a burst strength that is substantially equal. In an exemplary embodiment, the ratio of the interior diameters D_1 and D_2 to the interior diameter D_{INT} ranges from about 100% to 120% in order to facilitate the subsequent radial expansion of the tubular member 500.

In a preferred embodiment, the relationship between the wall thicknesses t_1, t_2, and t_{INT} of the tubular member 500; the inside diameters D_1, D_2 and D_{INT} of the tubular member 500; the inside diameter $D_{wellbore}$ of the wellbore casing, or other structure, that the tubular member 500 will be inserted into; and the outside diameter D_{cone} of the expansion cone that will be used to radially expand the tubular member 500 within the wellbore casing is given by the following expression:

$$Dwellbore - 2 * t_1 \geq \frac{1}{t_1}\left[(t_1 - t_{INT}) * D_{cone} + t_{INT} * D_{INT}\right]$$

where $t_1 = t_2$; and

$D_1 = D_2$.

By satisfying the relationship given in equation (1), the expansion forces placed upon

the tubular member 500 during the subsequent radial expansion process are substantially equalized. More generally, the relationship given in equation (1) may be used to calculate the optimal geometry for the tubular member 500 for subsequent radial expansion and plastic deformation of the tubular member 500 for fabricating and/or repairing a wellbore casing, a pipeline, or a structural support.

As illustrated in FIG. 5c, in step 420, conventional threaded connections, 500d and 500e, are formed in both expanded ends, 500a and 500b, of the tubular member 500. In an exemplary embodiment, the threaded connections, 500d and 500e, are provided using conventional processes for forming pin and box type threaded connections available from Atlas-Bradford.

As illustrated in Fig. 5d, in step 425, a sealing member 500f is then applied onto the outside diameter of the non-expanded intermediate portion 500c of the tubular member 500. The sealing member 500f may be applied to the outside diameter of the non-expanded intermediate portion 500c of the tubular member 500 using any number of conventional commercially available methods. In a preferred embodiment, the sealing member 500f is applied to the outside diameter of the intermediate portion 500c of the tubular member 500 using commercially available chemical and temperature resistant adhesive bonding.

In an exemplary embodiment, the expandable tubular members, 206, 214, and 220, of the system 200 are substantially identical to, and/or incorporate one or more of the teachings of, the tubular members 300 and 500.

Referring to Fig. 6, an exemplary embodiment of tubular expansion cone 600 for radially expanding the tubular members 206, 214, 220, 300 and 500 will now be described. The expansion cone 600 defines a passage 600a and includes a front end 605, a rear end 610, and a radial expansion section 615.

In an exemplary embodiment, the radial expansion section 615 includes a first conical outer surface 620 and a second conical outer surface 625. The first conical outer surface 620 includes an angle of attack α_1 and the second conical outer surface 625 includes an angle of attack α_2. In an exemplary embodiment, the angle of attack α_1 is

greater than the angle of attack α_2. In this manner, the first conical outer surface 620 optimally radially expands the intermediate portions, 206c, 214c, 220c, 300d, and 500c, of the tubular members, 206, 214, 220, 300, and 500, and the second conical outer surface 525 optimally radially expands the pre-expanded first and second ends, 206a and 206d, 214a and 214d, 220a and 220d, 300b and 300f, and 500a and 500b, of the tubular members, 206, 214, 220, 300 and 500. In an exemplary embodiment, the first conical outer surface 620 includes an angle of attack α_1 ranging from about 8 to 20 degrees, and the second conical outer surface 625 includes an angle of attack α_2 ranging from about 4 to 15 degrees in order to optimally radially expand and plastically deform the tubular members, 206, 214, 220, 300 and 500. More generally, the expansion cone 600 may include 3 or more adjacent conical outer surfaces having angles of attack that decrease from the front end 605 of the expansion cone 600 to the rear end 610 of the expansion cone 600.

Referring to Fig. 7, another exemplary embodiment of a tubular expansion cone 700 defines a passage 700a and includes a front end 705, a rear end 710, and a radial expansion section 715. In an exemplary embodiment, the radial expansion section 715 includes an outer surface having a substantially parabolic outer profile thereby providing a paraboloid shape. In this manner, the outer surface of the radial expansion section 715 provides an angle of attack that constantly decreases from a maximum at the front end 705 of the expansion cone 700 to a minimum at the rear end 710 of the expansion cone. The parabolic outer profile of the outer surface of the radial expansion section 715 may be formed using a plurality of adjacent discrete conical sections and/or using a continuous curved surface. In this manner, the region of the outer surface of the radial expansion section 715 adjacent to the front end 705 of the expansion cone 700 may optimally radially expand the intermediate portions, 206c, 214c, 220c, 300d, and 500c, of the tubular members, 206, 214, 220, 300, and 500, while the region of the outer surface of the radial expansion section 715 adjacent to the rear end 710 of the expansion cone 700 may optimally radially expand the pre-expanded first and second ends, 206a and 206d, 214a and 214d, 220a and 220d, 300b and 300f, and 500a and 500b, of the tubular members, 206, 214, 220, 300 and 500. In an exemplary embodiment, the parabolic profile of the outer surface of the radial expansion section 715 is selected to provide an angle of attack that ranges from about 8 to 20 degrees in the vicinity of the front end 705 of the expansion cone 700 and an

angle of attack in the vicinity of the rear end 710 of the expansion cone 700 from about 4 to 15 degrees.

In an exemplary embodiment, the tubular expansion cone 204 of the system 200 is substantially identical to the expansion cones 600 or 700, and/or incorporates one or more of the teachings of the expansion cones 600 and/or 700.

In several alternative embodiments, the teachings of the apparatus 130, the system 200, the expandable tubular member 300, the method 400, and/or the expandable tubular member 500 are at least partially combined.

Referring to Fig. 8, in an alternative embodiment, conventional temperature, pressure, and flow sensors, 802, 804, and 806, respectively, are operably coupled to the perforated tubulars 145 of the apparatus 130. The temperature, pressure, and flow sensors, 802, 804, and 806, respectively, in turn are operably coupled to a controller 810 that receives and processes the output signals generated by the temperature, pressure, and flow sensors to thereby control the operation of the flow control valves 160 to enhance the operational efficiency of the apparatus 130. In several exemplary embodiments, the control algorithms utilized by the controller 810 for controlling the operation of the flow control valves 160 as a function of the operating temperature, pressure, and flow rates within the perforated tubular members 145 are conventional.

Referring to Fig. 9, in an alternative embodiment, a solid tubular member 905 is coupled to one of the perforated tubular members 145 by radially expanding and plastically deforming the solid tubular member into engagement with the perforated tubular member in a conventional manner and/or using one or more of the radial expansion methods disclosed in one or more of the following: (1) U.S. patent application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, (2) U.S. patent application serial no. 09/510,913, attorney docket no. 25791.7.02, filed on 2/23/2000, (3) U.S. patent application serial no. 09/502,350, attorney docket no. 25791.8.02, filed on 2/10/2000, (4) U.S. patent application serial no. 09/440,338, attorney docket no. 25791.9.02, filed on 11/15/1999, (5) U.S. patent application serial no. 09/523,460, attorney docket no. 25791.11.02, filed on 3/10/2000, (6) U.S. patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000,

(7) U.S. patent application serial no. 09/511,941, attorney docket no. 25791.16.02, filed on 2/24/2000, (8) U.S. patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, (9) U.S. patent application serial no. 09/559,122, attorney docket no. 25791.23.02, filed on 4/26/2000, (10) PCT patent application serial no. PCT/US00/18635, attorney docket no. 25791.25.02, filed on 7/9/2000, (11) U.S. provisional patent application serial no. 60/162,671, attorney docket no. 25791.27, filed on 11/1/1999, (12) U.S. provisional patent application serial no. 60/154,047, attorney docket no. 25791.29, filed on 9/16/1999, (13) U.S. provisional patent application serial no. 60/159,082, attorney docket no. 25791.34, filed on 10/12/1999, (14) U.S. provisional patent application serial no. 60/159,039, attorney docket no. 25791.36, filed on 10/12/1999, (15) U.S. provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (16) U.S. provisional patent application serial no. 60/212,359, attorney docket no. 25791.38, filed on 6/19/2000, (17) U.S. provisional patent application serial no. 60/165,228, attorney docket no. 25791.39, filed on 11/12/1999, (18) U.S. provisional patent application serial no. 60/221,443, attorney docket no. 25791.45, filed on 7/28/2000, (19) U.S. provisional patent application serial no. 60/221,645, attorney docket no. 25791.46, filed on 7/28/2000, (20) U.S. provisional patent application serial no. 60/233,638, attorney docket no. 25791.47, filed on 9/18/2000, (21) U.S. provisional patent application serial no. 60/237,334, attorney docket no. 25791.48, filed on 10/2/2000, (22) U.S. provisional patent application serial no. 60/270,007, attorney docket no. 25791.50, filed on 2/20/2001; (23) U.S. provisional patent application serial no. 60/262,434, attorney docket no. 25791.51, filed on 1/17/2001; (24) U.S. provisional patent application serial no. 60/259,486, attorney docket no. 25791.52, filed on 1/3/2001; (25) U.S. provisional patent application serial no. 60/303,740, attorney docket no. 25791.61, filed on 7/6/2001; (26) U.S. provisional patent application serial no. 60/313,453, attorney docket no. 25791.59, filed on 8/20/2001; (27) U.S. provisional patent application serial no. 60/317,985, attorney docket no. 25791.67, filed on 9/6/2001; (28) U.S. provisional patent application serial no. 60,318,386, attorney docket no. 25791.67.02, filed on 9/10/2001; and (29) U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, the disclosures of which are incorporated herein by reference. In this manner, the solid tubular member 905 fluidicly seals the radial passages formed in the perforated tubular member 145 thereby preventing the passage of fluidic materials and/or formation materials through the perforated tubular member.

Referring to Fig. 10, in an alternative embodiment, the radial openings in one of the perforated tubular members 145 are sealed by injecting a hardenable fluidic sealing material 1005 into the radial openings in the one perforated tubular member by positioning a closed ended pipe 1010 having one or more radial openings 1010a within the one perforated tubular member 145. Conventional sealing members 1015 and 1020 then seal the interface between the pipe 1010 and the opposite ends of the one perforated tubular member 145. The hardenable fluidic sealing material 1005 is then injected into the radial openings in the one perforated tubular member 145. The sealing members 140 prevent the passage of the hardenable fluidic sealing material out of the annulus between the one perforated tubular member 145 and the formation 125. The pipe 1010 and sealing members, 1015 and 1020, are then removed from the apparatus 130, and the hardenable fluidic sealing material is allowed to cure. A conventional drill string may then be used to remove any excess cured sealing material from the interior surface of the one perforated tubular member 145. In an exemplary embodiment, the hardenable fluidic sealing material is a curable epoxy resin.

In an alternative embodiment, as illustrated in Fig. 11, one or more of the perforated tubular members 145 of the apparatus 130 are radially expanded and plastically deformed into contact with the surrounding formation 125 thereby compressing the surrounding formation. In this manner, the surrounding formation 125 is maintained in a state of compression thereby stabilizing the surrounding formation, reducing the flow of loose particles from the surrounding formation into the radial openings of the perforated tubular member 145, and enhancing the recovery of hydrocarbons from the surrounding formation.

In an alternative embodiment, a seismic source 1105 is positioned on a surface location to thereby impart seismic energy into the formation 125. In this manner, particles lodged in the radial openings in the perforated tubular member 145 may be dislodged from the radial openings thereby enhancing the subsequent recovery of hydrocarbons from the formation 125.

In an alternative embodiment, after the perforated tubular member 145 has been radially expanded and plastically formed into contact with the surrounding formation

125, thereby coupling the perforated tubular member 145 to the surrounding formation, an impulsive load is applied to the perforated tubular member. The impulsive load may be applied to the perforated tubular member 145 by applying the load to the end of the apparatus 130. The impulsive load is then transferred to the surrounding formation 125 thereby compacting and/or slurrifying the surrounding formation. As a result, the recovery of hydrocarbons from the formation 125 is enhanced.

In an alternative embodiment, as illustrated in Fig. 12, a wellbore casing 1205 having one or more perforations 1210 is positioned within the wellbore 105 that traverses the formation 125. When the apparatus 130 is positioned within the wellbore 105, one or more of the perforated tubular members 145 of the apparatus 130 are radially expanded and plastically deformed into contact with the wellbore casing 1205 thereby compressing the surrounding formation 125. In this manner, the surrounding formation 125 is maintained in a state of compression thereby stabilizing the surrounding formation, reducing the flow of loose particles from the surrounding formation into the radial openings of the perforated tubular member 145, and enhancing the recovery of hydrocarbons from the surrounding formation.

In an alternative embodiment, a seismic source 1215 is positioned on a surface location to thereby impart seismic energy into the formation 125. In this manner, particles lodged in the radial openings in the perforated tubular member 145 may be dislodged from the radial openings thereby enhancing the subsequent recovery of hydrocarbons from the formation 125.

In an alternative embodiment, after the perforated tubular member 145 has been radially expanded and plastically formed into contact with the wellbore casing 1205, thereby coupling the perforated tubular member 145 to the surrounding formation, an impulsive load is applied to the perforated tubular member. The impulsive load may be applied to the perforated tubular member 145 by applying the load to the end of the apparatus 130. The impulsive load is then transferred to the surrounding formation 125 thereby compacting and/or slurrifying the surrounding formation. As a result, the recovery of hydrocarbons from the formation 125 is enhanced.

Referring to Fig. 13, in an alternative embodiment, one or more perforated tubular members 1305 are coupled to one of the perforated tubular members 145 by radially expanding and plastically deforming the perforated tubular member into engagement with the perforated tubular member in a conventional manner and/or using one or more of the radial expansion methods disclosed in one or more of the following: (1) U.S. patent application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, (2) U.S. patent application serial no. 09/510,913, attorney docket no. 25791.7.02, filed on 2/23/2000, (3) U.S. patent application serial no. 09/502,350, attorney docket no. 25791.8.02, filed on 2/10/2000, (4) U.S. patent application serial no. 09/440,338, attorney docket no. 25791.9.02, filed on 11/15/1999, (5) U.S. patent application serial no. 09/523,460, attorney docket no. 25791.11.02, filed on 3/10/2000, (6) U.S. patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, (7) U.S. patent application serial no. 09/511,941, attorney docket no. 25791.16.02, filed on 2/24/2000, (8) U.S. patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, (9) U.S. patent application serial no. 09/559,122, attorney docket no. 25791.23.02, filed on 4/26/2000, (10) PCT patent application serial no. PCT/US00/18635, attorney docket no. 25791.25.02, filed on 7/9/2000, (11) U.S. provisional patent application serial no. 60/162,671, attorney docket no. 25791.27, filed on 11/1/1999, (12) U.S. provisional patent application serial no. 60/154,047, attorney docket no. 25791.29, filed on 9/16/1999, (13) U.S. provisional patent application serial no. 60/159,082, attorney docket no. 25791.34, filed on 10/12/1999, (14) U.S. provisional patent application serial no. 60/159,039, attorney docket no. 25791.36, filed on 10/12/1999, (15) U.S. provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (16) U.S. provisional patent application serial no. 60/212,359, attorney docket no. 25791.38, filed on 6/19/2000, (17) U.S. provisional patent application serial no. 60/165,228, attorney docket no. 25791.39, filed on 11/12/1999, (18) U.S. provisional patent application serial no. 60/221,443, attorney docket no. 25791.45, filed on 7/28/2000, (19) U.S. provisional patent application serial no. 60/221,645, attorney docket no. 25791.46, filed on 7/28/2000, (20) U.S. provisional patent application serial no. 60/233,638, attorney docket no. 25791.47, filed on 9/18/2000, (21) U.S. provisional patent application serial no. 60/237,334, attorney docket no. 25791.48, filed on 10/2/2000, (22) U.S. provisional patent application serial no. 60/270,007, attorney docket no. 25791.50, filed on 2/20/2001; (23) U.S. provisional patent application serial no. 60/262,434, attorney

docket no. 25791.51, filed on 1/17/2001; (24) U.S, provisional patent application serial no. 60/259,486, attorney docket no. 25791.52, filed on 1/3/2001; (25) U.S. provisional patent application serial no. 60/303,740, attorney docket no. 25791.61, filed on 7/6/2001; (26) U.S. provisional patent application serial no. 60/313,453, attorney docket no. 25791.59, filed on 8/20/2001; (27) U.S. provisional patent application serial no. 60/317,985, attorney docket no. 25791.67, filed on 9/6/2001; (28) U.S. provisional patent application serial no. 60/318,386, attorney docket no. 25791.67.02, filed on 9/10/2001; and (29) U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, the disclosures of which are incorporated herein by reference. In this manner, the perforated tubular member 905 modifies the flow characteristics of the perforated tubular member 145 thereby permitting the operator of the apparatus 130 to modify the overall flow characteristics of the apparatus.

In an alternative embodiment, as illustrated in Fig. 14, a one-way valve 1405 such as, for example, a check valve fluidicly couples the interior of a pair of adjacent perforated tubular members, 145a and 145b, that extract hydrocarbons from corresponding subterranean zones A and B. In this manner, if zone B becomes depleted, hydrocarbons that are being extracted from zone A will not flow into the depleted zone B.

In an alternative embodiment, as illustrated in Fig. 15, the apparatus 130 is used to extract geothermal energy from a targeted subterranean geothermal zone 1505. In this manner, the operational efficiency of the extraction of geothermal energy is significantly enhanced due to the increased internal diameters of the various radially expanded elements of the apparatus 130 that permit greater volumetric flows.

In an alternative embodiment, the perforated tubular members, 145, 210, 212, 216, 218, and 1305 of the apparatus 130 may be cleaned by further radial expansion of the perforated tubular members. In an exemplary embodiment, the amount of further radial expansion required to clean the radial passages of the perforated tubular members 145, 210, 212, 216, 218, and 1305 of the apparatus 130 ranged from about 1% to 2%.

An apparatus has been described that includes a zonal isolation assembly including one or more solid tubular members, each solid tubular member including one or more

external seals, and one or more perforated tubular members coupled to the solid tubular members, and a shoe coupled to the zonal isolation assembly. In an exemplary embodiment, the zonal isolation assembly further includes one or more intermediate solid tubular members coupled to and interleaved among the perforated tubular members, each intermediate solid tubular member including one or more external seals. In an exemplary embodiment, the zonal isolation assembly further includes one or more valve members for controlling the flow of fluidic materials between the tubular members. In an exemplary embodiment, one or more of the intermediate solid tubular members include one or more valve members.

An apparatus has also been described that includes a zonal isolation assembly that includes one or more primary solid tubulars, each primary solid tubular including one or more external annular seals, n perforated tubulars coupled to the primary solid tubulars, and n-1 intermediate solid tubulars coupled to and interleaved among the perforated tubulars, each intermediate solid tubular including one or more external annular seals, and a shoe coupled to the zonal isolation assembly.

A method of isolating a first subterranean zone from a second subterranean zone in a wellbore has also been described that includes positioning one or more primary solid tubulars within the wellbore, the primary solid tubulars traversing the first subterranean zone, positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the second subterranean zone, fluidicly coupling the perforated tubulars and the primary solid tubulars, and preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid and perforated tubulars.

A method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, has also been described that includes positioning one or more primary solid tubulars within the wellbore, fluidicly coupling the primary solid tubulars with the casing, positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the producing subterranean zone, fluidicly coupling the perforated tubulars with the primary solid tubulars, fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, and fluidicly coupling at least one of the perforated tubulars with the

producing subterranean zone. In an exemplary embodiment, the method further includes controllably fluidicly decoupling at least one of the perforated tubulars from at least one other of the perforated tubulars.

An apparatus has also been described that includes a subterranean formation including a wellbore, a zonal isolation assembly at least partially positioned within the wellbore that includes one or more solid tubular members, each solid tubular member including one or more external seals, and one or more perforated tubular members coupled to the solid tubular members, and a shoe positioned within the wellbore coupled to the zonal isolation assembly, wherein at least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore. In an exemplary embodiment, the zonal isolation assembly further includes one or more intermediate solid tubular members coupled to and interleaved among the perforated tubular members, each intermediate solid tubular member including one or more external seals, wherein at least one of the solid tubular members, the perforated tubular members, and the intermediate solid tubular members are formed by a radial expansion process performed within the wellbore. In an exemplary embodiment, the zonal isolation assembly further comprises one or more valve members for controlling the flow of fluids between the solid tubular members and the perforated tubular members. In an exemplary embodiment, one or more of the intermediate solid tubular members include one or more valve members for controlling the flow of fluids between the solid tubular members and the perforated tubular members.

An apparatus has also been described that includes a subterranean formation including a wellbore, a zonal isolation assembly positioned within the wellbore that includes one or more primary solid tubulars, each primary solid tubular including one or more external annular seals, n perforated tubulars positioned coupled to the primary solid tubulars, and n-1 intermediate solid tubulars coupled to and interleaved among the perforated tubulars, each intermediate solid tubular including one or more external annular seals, and a shoe coupled to the zonal isolation assembly, wherein at least one of the primary solid tubulars, the perforated tubulars, and the intermediate solid tubulars are formed by a radial expansion process performed within the wellbore.

A method of isolating a first subterranean zone from a second subterranean zone in a wellbore has also been described that includes positioning one or more primary solid tubulars within the wellbore, the primary solid tubulars traversing the first subterranean zone, positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the second subterranean zone, radially expanding at least one of the primary solid tubulars and perforated tubulars within the wellbore, fluidicly coupling the perforated tubulars and the primary solid tubulars, and preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars.

A method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, has also been described that includes positioning one or more primary solid tubulars within the wellbore, positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the producing subterranean zone, radially expanding at least one of the primary solid tubulars and the perforated tubulars within the wellbore, fluidicly coupling the primary solid tubulars with the casing, fluidicly coupling the perforated tubulars with the primary solid tubulars, fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, and fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone. In an exemplary embodiment, the method further includes controllably fluidicly decoupling at least one of the perforated tubulars from at least one other of the perforated tubulars.

An apparatus has also been described that includes a subterranean formation including a wellbore, a zonal isolation assembly positioned within the wellbore that includes n solid tubular members positioned within the wellbore, each solid tubular member including one or more external seals, and n-1 perforated tubular members positioned within the wellbore coupled to and interleaved among the solid tubular members, and a shoe positioned within the wellbore coupled to the zonal isolation assembly. In an exemplary embodiment, the zonal isolation assembly further comprises one or more valve members for controlling the flow of fluids between the solid tubular members and the perforated tubular members. In an exemplary embodiment, one or more of the solid tubular members include one or more valve members for controlling the flow of fluids between the solid tubular members and the perforated tubular members.

A system for isolating a first subterranean zone from a second subterranean zone in a wellbore has also been described that includes means for positioning one or more primary solid tubulars within the wellbore, the primary solid tubulars traversing the first subterranean zone, means for positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the second subterranean zone, means for fluidicly coupling the perforated tubulars and the primary solid tubulars, and means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and the perforated tubulars.

A system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, has also been described that includes means for positioning one or more primary solid tubulars within the wellbore, means for fluidicly coupling the primary solid tubulars with the casing, means for positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the producing subterranean zone, means for fluidicly coupling the perforated tubulars with the primary solid tubulars, means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, and means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone. In an exemplary embodiment, the system further includes means for controllably fluidicly decoupling at least one of the perforated tubulars from at least one other of the perforated tubulars.

A system for isolating a first subterranean zone from a second subterranean zone in a wellbore has also been described that includes means for positioning one or more primary solid tubulars within the wellbore, the primary solid tubulars traversing the first subterranean zone, means for positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the second subterranean zone, means for radially expanding at least one of the primary solid tubulars and perforated tubulars within the wellbore, means for fluidicly coupling the perforated tubulars and the primary solid tubulars, and means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars.

A system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, has also been described that includes means for positioning one or more primary solid tubulars within the wellbore, means for positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the producing subterranean zone, means for radially expanding at least one of the primary solid tubulars and the perforated tubulars within the wellbore, means for fluidicly coupling the primary solid tubulars with the casing, means for fluidicly coupling the perforated tubulars with the solid tubulars, means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, and means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone. In an exemplary embodiment, the system further includes means for controllably fluidicly decoupling at least one of the perforated tubulars from at least one other of the perforated tubulars.

A system for isolating subterranean zones traversed by a wellbore has also been described that includes a tubular support member defining a first passage, a tubular expansion cone defining a second passage fluidicly coupled to the first passage coupled to an end of the tubular support member and comprising a tapered end, a tubular liner coupled to and supported by the tapered end of the tubular expansion cone, and a shoe defining a valveable passage coupled to an end of the tubular liner, wherein the tubular liner includes one or more expandable tubular members that each include a tubular body comprising an intermediate portion and first and second expanded end portions coupled to opposing ends of the intermediate portion, and a sealing member coupled to the exterior surface of the intermediate portion, and one or more slotted tubular members coupled to the expandable tubular members, wherein the inside diameters of the other tubular members are greater than or equal to the outside diameter of the tubular expansion cone. In an exemplary embodiment, the wall thicknesses of the first and second expanded end portions are greater than the wall thickness of the intermediate portion. In an exemplary embodiment, each expandable tubular member further includes a first tubular transitionary member coupled between the first expanded end portion and the intermediate portion, and a second tubular transitionary member coupled between the second expanded end portion and the intermediate portion, wherein the angles of inclination of the first and second tubular

transitionary members relative to the intermediate portion ranges from about 0 to 30 degrees. In an exemplary embodiment, the outside diameter of the intermediate portion ranges from about 75 percent to about 98 percent of the outside diameters of the first and second expanded end portions. In an exemplary embodiment, the burst strength of the first and second expanded end portions is substantially equal to the burst strength of the intermediate tubular section. In an exemplary embodiment, the ratio of the inside diameters of the first and second expanded end portions to the interior diameter of the intermediate portion ranges from about 100 to 120 percent. In an exemplary embodiment, the relationship between the wall thicknesses t_1, t_2, and t_{INT} of the first expanded end portion, the second expanded end portion, and the intermediate portion, respectively, of the expandable tubular members, the inside diameters D_1, D_2 and D_{INT} of the first expanded end portion, the second expanded end portion, and the intermediate portion, respectively, of the expandable tubular members, and the inside diameter $D_{wellbore}$ of the wellbore casing that the expandable tubular member will be inserted into, and the outside diameter D_{cone} of the expansion cone that will be used to radially expand the expandable tubular member within the wellbore is given by the following expression:

$$Dwellbore - 2 * t_1 \geq \frac{1}{t_1}\left[(t_1 - t_{INT}) * D_{cone} + t_{INT} * D_{INT}\right]$$

wherein $t_1 = t_2$; and wherein $D_1 = D_2$. In an exemplary embodiment, the tapered end of the tubular expansion cone includes a plurality of adjacent discrete tapered sections. In an exemplary embodiment, the angle of attack of the adjacent discrete tapered sections increases in a continuous manner from one end of the tubular expansion cone to the opposite end of the tubular expansion cone. In an exemplary embodiment, the tapered end of the tubular expansion cone includes an paraboloid body. In an exemplary embodiment, the angle of attack of the outer surface of the paraboloid body increases in a continuous manner from one end of the paraboloid body to the opposite end of the paraboloid body. In an exemplary embodiment, the tubular liner comprises a plurality of expandable tubular members; and wherein the other tubular members are interleaved among the expandable tubular members.

A method of isolating subterranean zones traversed by a wellbore has also been described that includes positioning a tubular liner within the wellbore, and radially expanding one or more discrete portions of the tubular liner into engagement with the

wellbore. In an exemplary embodiment, a plurality of discrete portions of the tubular liner are radially expanded into engagement with the wellbore. In an exemplary embodiment, the remaining portions of the tubular liner are not radially expanded. In an exemplary embodiment, one of the discrete portions of the tubular liner is radially expanded by injecting a fluidic material into the tubular liner; and wherein the remaining ones of the discrete portions of the tubular liner are radially expanded by pulling an expansion cone through the remaining ones of the discrete portions of the tubular liner. In an exemplary embodiment, the tubular liner comprises a plurality of tubular members; and wherein one or more of the tubular members are radially expanded into engagement with the wellbore and one or more of the tubular members are not radially expanded into engagement with the wellbore. In an exemplary embodiment, the tubular members that are radially expanded into engagement with the wellbore comprise a portion that is radially expanded into engagement with the wellbore and a portion that is not radially expanded into engagement with the wellbore. In an exemplary embodiment, the tubular liner includes one or more expandable tubular members that each include a tubular body comprising an intermediate portion and first and second expanded end portions coupled to opposing ends of the intermediate portion, and a sealing member coupled to the exterior surface of the intermediate portion, and one or more slotted tubular members coupled to the expandable tubular members, wherein the inside diameters of the slotted tubular members are greater than or equal to the maximum inside diameters of the expandable tubular members. In an exemplary embodiment, the tubular liner includes a plurality of expandable tubular members; and wherein the slotted tubular members are interleaved among the expandable tubular members.

A system for isolating subterranean zones traversed by a wellbore has also been described that includes means for positioning a tubular liner within the wellbore, and means for radially expanding one or more discrete portions of the tubular liner into engagement with the wellbore. In an exemplary embodiment, a plurality of discrete portions of the tubular liner are radially expanded into engagement with the wellbore. In an exemplary embodiment, the remaining portions of the tubular liner are not radially expanded. In an exemplary embodiment, one discrete portion of the tubular liner is radially expanded by injecting a fluidic material into the tubular liner; and wherein the other discrete portions of the tubular liner are radially expanded by pulling an

expansion cone through the other discrete portions of the tubular liner. In an exemplary embodiment, the tubular liner includes a plurality of tubular members; and wherein one or more of the tubular members are radially expanded into engagement with the wellbore and one or more of the tubular members are not radially expanded into engagement with the wellbore. In an exemplary embodiment, the tubular members that are radially expanded into engagement with the wellbore include a portion that is radially expanded into engagement with the wellbore and a portion that is not radially expanded into engagement with the wellbore.

An apparatus for isolating subterranean zones has also been described that includes a subterranean formation defining a borehole, and a tubular liner positioned in and coupled to the borehole at one or more discrete locations. In an exemplary embodiment, the tubular liner is coupled to the borehole at a plurality of discrete locations. In an exemplary embodiment, the tubular liner is coupled to the borehole by a process that includes positioning the tubular liner within the borehole, and radially expanding one or more discrete portions of the tubular liner into engagement with the borehole. In an exemplary embodiment, a plurality of discrete portions of the tubular liner are radially expanded into engagement with the borehole. In an exemplary embodiment, the remaining portions of the tubular liner are not radially expanded. In an exemplary embodiment, one of the discrete portions of the tubular liner is radially expanded by injecting a fluidic material into the tubular liner; and wherein the other discrete portions of the tubular liner are radially expanded by pulling an expansion cone through the other discrete portions of the tubular liner. In an exemplary embodiment, the tubular liner comprises a plurality of tubular members; and wherein one or more of the tubular members are radially expanded into engagement with the borehole and one or more of the tubular members are not radially expanded into engagement with the borehole. In an exemplary embodiment, the tubular members that are radially expanded into engagement with the borehole include a portion that is radially expanded into engagement with the borehole and a portion that is not radially expanded into engagement with the borehole. In an exemplary embodiment, prior to the radial expansion the tubular liner includes one or more expandable tubular members that each include a tubular body comprising an intermediate portion and first and second expanded end portions coupled to opposing ends of the intermediate portion, and a sealing member coupled to the exterior surface of the intermediate

portion, and one or more slotted tubular members coupled to the expandable tubular members, wherein the inside diameters of the slotted tubular members are greater than or equal to the maximum inside diameters of the expandable tubular members. In an exemplary embodiment, the tubular liner includes a plurality of expandable tubular members; and wherein the slotted tubular members are interleaved among the expandable tubular members.

An apparatus has been described that includes a zonal isolation assembly including: one or more solid tubular members, each solid tubular member including one or more external seals, one or more perforated tubular members coupled to the solid tubular members, one or more flow control valves operably coupled to the perforated tubular members for controlling the flow of fluidic materials through the perforated tubular members, one or more temperature sensors operably coupled to one or more of the perforated tubular members for monitoring the operating temperature within the perforated tubular members, one or more pressure sensors operably coupled to one or more of the perforated tubular members for monitoring the operating pressure within the perforated tubular members, and one or more flow sensors operably coupled to one or more of the perforated tubular members for monitoring the operating flow rate within the perforated tubular members, a shoe coupled to the zonal isolation assembly, and a controller operably coupled to the flow control valves, the temperature sensors, the pressure sensors, and the flow sensors for monitoring the temperature, pressure and flow sensors and controlling the operation of the flow control valves. At least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore.

A method of isolating a first subterranean zone from a second subterranean zone in a wellbore has also been described that includes positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the second subterranean zone, radially expanding at least one of the primary solid tubulars and perforated tubulars within the wellbore, fluidicly coupling the perforated tubulars and the solid tubulars, preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars, monitoring the operating temperatures,

pressures, and flow rates within one or more of the perforated tubulars, and controlling the flow of fluidic materials through the perforated tubulars as a function of the monitored operating temperatures, pressures, and flow rates.

A method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, has also been described that includes positioning one or more solid tubulars within the wellbore, positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the producing subterranean zone, radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, fluidicly coupling the solid tubulars with the casing, fluidicly coupling the perforated tubulars with the solid tubulars, fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, monitoring the operating temperatures, pressures, and flow rates within one or more of the perforated tubulars, and controlling the flow of fluidic materials through the perforated tubulars as a function of the monitored operating temperatures, pressures, and flow rates.

A system for isolating a first subterranean zone from a second subterranean zone in a wellbore has also been described that includes means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, means for positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the second subterranean zone, means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, means for fluidicly coupling the perforated tubulars and the solid tubulars, means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars, means for monitoring the operating temperatures, pressures, and flow rates within one or more of the perforated tubulars, and means for controlling the flow of fluidic materials through the perforated tubulars as a function of the monitored operating temperatures, pressures, and flow rates.

A system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, has also been described that includes

means for positioning one or more solid tubulars within the wellbore, means for positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the producing subterranean zone, means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, means for fluidicly coupling the solid tubulars with the casing, means for fluidicly coupling the perforated tubulars with the solid tubulars, means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, means for monitoring the operating temperatures, pressures, and flow rates within one or more of the perforated tubulars, and means for controlling the flow of fluidic materials through the perforated tubulars as a function of the monitored operating temperatures, pressures, and flow rates.

An apparatus has also been described that includes a zonal isolation assembly including: one or more solid tubular members, each solid tubular member including one or more external seals, one or more perforated tubular members each including radial passages coupled to the solid tubular members, and one or more solid tubular liners coupled to the interior surfaces of one or more of the perforated tubular members for sealing at least some of the radial passages of the perforated tubular members, and a shoe coupled to the zonal isolation assembly. At least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore, and the solid tubular liners are formed by a radial expansion process performed within the wellbore.

A method of isolating a first subterranean zone from a second subterranean zone in a wellbore has also been described that includes positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone, radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, fluidicly coupling the perforated tubulars and the primary solid tubulars, preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars, positioning one or more solid tubular liners within the interior of one or more of the

perforated tubulars, and radially expanding and plastically deforming the solid tubular liners within the interior of one or more of the perforated tubulars to fluidicly seal at least some of the radial passages of the perforated tubulars.

A method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, has also been described that includes positioning one or more solid tubulars within the wellbore, positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zone, radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, fluidicly coupling the solid tubulars with the casing, fluidicly coupling the perforated tubulars with the solid tubulars, fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, positioning one or more solid tubular liners within the interior of one or more of the perforated tubulars, and radially expanding and plastically deforming the solid tubular liners within the interior of one or more of the perforated tubulars to fluidicly seal at least some of the radial passages of the perforated tubulars.

A system for isolating a first subterranean zone from a second subterranean zone in a wellbore has also been described that includes means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone, means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, means for fluidicly coupling the perforated tubulars and the solid tubulars, means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars, means for positioning one or more solid tubular liners within the interior of one or more of the perforated tubulars, and means for radially expanding and plastically deforming the solid tubular liners within the interior of one or more of the perforated tubulars to fluidicly seal at least some of the radial passages of the perforated tubulars.

According to another aspect of the present invention, a system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, has also been described that includes means for positioning one or more solid tubulars within the wellbore, means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zone, means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, means for fluidicly coupling the solid tubulars with the casing, means for fluidicly coupling the perforated tubulars with the solid tubulars, means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, means for positioning one or more solid tubular liners within the interior of one or more of the perforated tubulars, and means for radially expanding and plastically deforming the solid tubular liners within the interior of one or more of the perforated tubulars to fluidicly seal at least some of the radial passages of the perforated tubulars.

An apparatus has also been described that includes a zonal isolation assembly including: one or more solid tubular members, each solid tubular member including one or more external seals, one or more perforated tubular members each including radial passages coupled to the solid tubular members, and a sealing material coupled to at least some of the perforated tubular members for sealing at least some of the radial passages of the perforated tubular members, and a shoe coupled to the zonal isolation assembly.

A method of isolating a first subterranean zone from a second subterranean zone in a wellbore has also been described that includes positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone, radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, fluidicly coupling the perforated tubulars and the primary solid tubulars, preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars,

sealing off an annular region within at least one of the perforated tubulars, and injecting a hardenable fluidic sealing material into the sealed annular regions of the perforated tubulars to seal off at least some of the radial passages of the perforated tubulars.

A method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, has also been described that includes positioning one or more solid tubulars within the wellbore, positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zone, radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, fluidicly coupling the solid tubulars with the casing, fluidicly coupling the perforated tubulars with the solid tubulars, fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, sealing off an annular region within at least one of the perforated tubulars, and injecting a hardenable fluidic sealing material into the sealed annular regions of the perforated tubulars to seal off at least some of the radial passages of the perforated tubulars.

A system for isolating a first subterranean zone from a second subterranean zone in a wellbore has also been described that includes means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone, means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, means for fluidicly coupling the perforated tubulars and the solid tubulars, means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars, means for sealing off an annular region within at least one of the perforated tubulars, and means for injecting a hardenable fluidic sealing material into the sealed annular regions of the perforated tubulars to seal off at least some of the radial passages of the perforated tubulars.

A system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, has also been described that includes

means for positioning one or more solid tubulars within the wellbore, means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zone, means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, means for fluidicly coupling the solid tubulars with the casing, means for fluidicly coupling the perforated tubulars with the solid tubulars, means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, means for sealing off an annular region within at least one of the perforated tubulars, and means for injecting a hardenable fluidic sealing material into the sealed annular regions of the perforated tubulars to seal off at least some of the radial passages of the perforated tubulars.

An apparatus has also been described that includes a zonal isolation assembly positioned within a wellbore that traverses a subterranean formation including: one or more solid tubular members, each solid tubular member including one or more external seals, one or more perforated tubular members coupled to the solid tubular members, and a shoe coupled to the zonal isolation assembly. At least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore, and at least one of the perforated tubular members are radially expanded into intimate contact with the subterranean formation. In an exemplary embodiment, the perforated tubular members that are radially expanded into intimate contact with the subterranean formation compress the subterranean formation.

A method of isolating a first subterranean zone from a second subterranean zone in a wellbore has also been described that includes positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the second subterranean zone, radially expanding at least one of the primary solid tubulars and perforated tubulars within the wellbore, radially expanding at least one of the perforated tubulars into intimate contact with the second subterranean zone, fluidicly coupling the perforated tubulars and the

solid tubulars, and preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars. In an exemplary embodiment, the perforated tubulars that are radially expanded into intimate contact with the second subterranean zone compress the second subterranean zone. In an exemplary embodiment, the method further includes vibrating the second subterranean zone to increase the rate of recovery of hydrocarbons from the second subterranean zone. In an exemplary embodiment, the method further includes vibrating the second subterranean zone to clean the radial passages of the perforated tubulars that are radially expanded into intimate contact with the second subterranean zone. In an exemplary embodiment, the method further includes applying an impulsive load to the perforated tubulars that are radially expanded into intimate contact with the second subterranean zone to increase the rate of recovery of hydrocarbons from the second subterranean zone.

A method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, has also been described that includes positioning one or more solid tubulars within the wellbore, positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the producing subterranean zone, radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, radially expanding at least one of the perforated tubulars into intimate contact with the producing subterranean zone, fluidicly coupling the solid tubulars with the casing, fluidicly coupling the perforated tubulars with the solid tubulars, fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, and fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone. In an exemplary embodiment, the perforated tubulars that are radially expanded into intimate contact with the producing subterranean zone compress the producing subterranean zone. In an exemplary embodiment, the method further includes vibrating the producing subterranean zone to increase the rate of recovery of hydrocarbons from the producing subterranean zone. In an exemplary embodiment, the method further includes vibrating the producing subterranean zone to clean the radial passages of the perforated tubulars that are radially expanded into intimate contact with the producing subterranean zone. In an exemplary embodiment, the method further includes applying an impulsive load to the perforated tubulars that

are radially expanded into intimate contact with the producing subterranean zone to increase the rate of recovery of hydrocarbons from the producing subterranean zone.

A system for isolating a first subterranean zone from a second subterranean zone in a wellbore has also been described that includes means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, means for positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the second subterranean zone, means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, means for radially expanding at least one of the perforated tubulars into intimate contact with the second subterranean zone, means for fluidicly coupling the perforated tubulars and the solid tubulars, and means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars. In an exemplary embodiment, the means for radially expanding at least one of the perforated tubulars into intimate contact with the second subterranean zone comprises means for compressing the second subterranean zone. In an exemplary embodiment, the system further includes means for vibrating the second subterranean zone to increase the rate of recovery of hydrocarbons from the second subterranean zone. In an exemplary embodiment, the system further includes means for vibrating the second subterranean zone to clean the radial passages of the perforated tubulars that are radially expanded into intimate contact with the second subterranean zone. In an exemplary embodiment, the system further includes means for applying an impulsive load to the perforated tubulars that are radially expanded into intimate contact with the second subterranean zone to increase the rate of recovery of hydrocarbons from the second subterranean zone.

A system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, has also been described that includes means for positioning one or more solid tubulars within the wellbore, means for positioning one or more perforated tubulars within the wellbore each including one or more radial openings, the perforated tubulars traversing the producing subterranean zone, means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, means for radially expanding at least one of the perforated

tubulars into intimate contact with the producing subterranean zone, means for fluidicly coupling the solid tubulars with the casing, means for fluidicly coupling the perforated tubulars with the solid tubulars, means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, and means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone. In an exemplary embodiment, the means for radially expanding at least one of the perforated tubulars into intimate contact with the producing subterranean zone comprises means for compressing the producing subterranean zone. In an exemplary embodiment, the system further includes means for vibrating the producing subterranean zone to increase the rate of recovery of hydrocarbons from the producing subterranean zone. In an exemplary embodiment, the system further includes means for vibrating the producing subterranean zone to clean the radial passages of the perforated tubulars that are radially expanded into intimate contact with the producing subterranean zone. In an exemplary embodiment, the system further includes means for applying an impulsive load to the perforated tubulars that are radially expanded into intimate contact with the producing subterranean zone to increase the rate of recovery of hydrocarbons from the producing subterranean zone.

An apparatus has also been described that includes a zonal isolation assembly positioned within a wellbore that traverses a subterranean formation and includes a perforated wellbore casing, including: one or more solid tubular members, each solid tubular member including one or more external seals, one or more perforated tubular members coupled to the solid tubular members, and a shoe coupled to the zonal isolation assembly. At least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore, and at least one of the perforated tubular members are radially expanded into intimate contact with the perforated wellbore casing. In an exemplary embodiment, the perforated tubular members that are radially expanded into intimate contact with the perforated casing compress the subterranean formation.

A method of isolating a first subterranean zone from a second subterranean zone in a wellbore that includes a perforated casing that traverses the second subterranean zone, has also been described that includes positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, positioning

one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the second subterranean zone, radially expanding at least one of the primary solid tubulars and perforated tubulars within the wellbore, radially expanding at least one of the perforated tubulars into intimate contact with the perforated casing, fluidicly coupling the perforated tubulars and the solid tubulars, and preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars. In an exemplary embodiment, the perforated tubulars that are radially expanded into intimate contact with the perforated casing compress the second subterranean zone. In an exemplary embodiment, the method further includes vibrating the second subterranean zone to increase the rate of recovery of hydrocarbons from the second subterranean zone. In an exemplary embodiment, the method further includes vibrating the second subterranean zone to clean the radial passages of the perforated tubulars that are radially expanded into intimate contact with the perforated casing. In an exemplary embodiment, the method further includes applying an impulsive load to the perforated tubulars that are radially expanded into intimate contact with the perforated casing to increase the rate of recovery of hydrocarbons from the second subterranean zone.

A method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing and a perforated casing that traverses the producing subterranean zone, has also been described that includes positioning one or more solid tubulars within the wellbore, positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the producing subterranean zone, radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, radially expanding at least one of the perforated tubulars into intimate contact with the perforated casing, fluidicly coupling the solid tubulars with the casing, fluidicly coupling the perforated tubulars with the solid tubulars, fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, and fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone. In an exemplary embodiment, the perforated tubulars that are radially expanded into intimate contact with the perforated casing compress the producing subterranean zone. In an exemplary embodiment, the method further includes vibrating the producing

subterranean zone to increase the rate of recovery of hydrocarbons from the producing subterranean zone. In an exemplary embodiment, the method further includes vibrating the producing subterranean zone to clean the radial passages of the perforated tubulars that are radially expanded into intimate contact with the perforated casing. In an exemplary embodiment, the method further includes applying an impulsive load to the perforated tubulars that are radially expanded into intimate contact with the perforated tubulars to increase the rate of recovery of hydrocarbons from the producing subterranean zone.

A system for isolating a first subterranean zone from a second subterranean zone in a wellbore that includes a perforated casing that traverses the second subterranean zone, has also been described that includes means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, means for positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the second subterranean zone, means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, means for radially expanding at least one of the perforated tubulars into intimate contact with the perforated casing, means for fluidicly coupling the perforated tubulars and the solid tubulars, and means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars. In an exemplary embodiment, the means for radially expanding at least one of the perforated tubulars into intimate contact with the perforated casing comprises means for compressing the second subterranean zone. In an exemplary embodiment, the system further includes means for vibrating the second subterranean zone to increase the rate of recovery of hydrocarbons from the second subterranean zone. In an exemplary embodiment, the system further includes means for vibrating the second subterranean zone to clean the radial passages of the perforated tubulars that are radially expanded into intimate contact with the perforated casing. In an exemplary embodiment, the system further includes means for applying an impulsive load to the perforated tubulars that are radially expanded into intimate contact with the perforated casing to increase the rate of recovery of hydrocarbons from the second subterranean zone.

A system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing and a perforated casing that traverses the producing subterranean zone, has also been described that includes means for positioning one or more solid tubulars within the wellbore, means for positioning one or more perforated tubulars within the wellbore each including one or more radial openings, the perforated tubulars traversing the producing subterranean zone, means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, means for radially expanding at least one of the perforated tubulars into intimate contact with the perforated casing, means for fluidicly coupling the solid tubulars with the casing, means for fluidicly coupling the perforated tubulars with the solid tubulars, means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, and means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone. In an exemplary embodiment, the means for radially expanding at least one of the perforated tubulars into intimate contact with the perforated casing comprises means for compressing the producing subterranean zone. In an exemplary embodiment, the further includes means for vibrating the producing subterranean zone to increase the rate of recovery of hydrocarbons from the producing subterranean zone. In an exemplary embodiment, the system further includes means for vibrating the producing subterranean zone to clean the radial passages of the perforated tubulars that are radially expanded into intimate contact with the perforated casing. In an exemplary embodiment, the system further includes means for applying an impulsive load to the perforated tubulars that are radially expanded into intimate contact with the perforated casing to increase the rate of recovery of hydrocarbons from the producing subterranean zone.

An apparatus has also been described that includes a zonal isolation assembly including: one or more solid tubular members, each solid tubular member including one or more external seals, one or more perforated tubular members each including radial passages coupled to the solid tubular members, and one or more perforated tubular liners each including one or more radial passages coupled to the interior surfaces of one or more of the perforated tubular members, and a shoe coupled to the zonal isolation assembly. At least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the

wellbore, and the perforated tubular liners are formed by a radial expansion process performed within the wellbore.

A method of isolating a first subterranean zone from a second subterranean zone in a wellbore has also been described that includes positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone, radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, fluidicly coupling the perforated tubulars and the primary solid tubulars, preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars, positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars, and radially expanding and plastically deforming the perforated tubular liners within the interior of one or more of the perforated tubulars.

A method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, has also been described that includes positioning one or more solid tubulars within the wellbore, positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zone, radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, fluidicly coupling the solid tubulars with the casing, fluidicly coupling the perforated tubulars with the solid tubulars, fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars, and radially expanding and plastically deforming the perforated tubular liners within the interior of one or more of the perforated tubulars.

A system for isolating a first subterranean zone from a second subterranean zone in a wellbore has also been described that includes means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, means for positioning one or more perforated tubulars each including one or more

radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone, means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, means for fluidicly coupling the perforated tubulars and the solid tubulars, means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars, means for positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars, and means for radially expanding and plastically deforming the perforated tubular liners within the interior of one or more of the perforated tubulars.

A system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, has also been described that includes means for positioning one or more solid tubulars within the wellbore, means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zone, means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, means for fluidicly coupling the solid tubulars with the casing, means for fluidicly coupling the perforated tubulars with the solid tubulars, means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, means for positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars, and means for radially expanding and plastically deforming the perforated tubular liners within the interior of one or more of the perforated tubulars.

An apparatus has also been described that includes a zonal isolation assembly including: one or more solid tubular members, each solid tubular member including one or more external seals, two or more perforated tubular members each including radial passages coupled to the solid tubular members, and one or more one-way valves for controllably fluidicly coupling the perforated tubular members, and a shoe coupled to the zonal isolation assembly. At least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore.

A method of isolating a first subterranean zone from a second subterranean zone having a plurality of producing zones in a wellbore has also been described that includes positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, positioning two or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone, radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, fluidicly coupling the perforated tubulars and the primary solid tubulars, preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars, and preventing fluids from passing from one of the producing zones that has not been depleted to one of the producing zones that has been depleted.

A method of extracting materials from a wellbore having a plurality of producing subterranean zones, at least a portion of the wellbore including a casing, has also been described that includes positioning one or more solid tubulars within the wellbore, positioning two or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zones, radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, fluidicly coupling the solid tubulars with the casing, fluidicly coupling the perforated tubulars with the solid tubulars, fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, preventing fluids from passing from one of the producing zones that has not been depleted to one of the producing zones that has been depleted.

A system for isolating a first subterranean zone from a second subterranean zone having a plurality of producing zones in a wellbore has also been described that includes means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone, means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, means for fluidicly coupling the perforated tubulars and the solid tubulars, means for

preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars, means for positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars, and means for preventing fluids from passing from one of the producing zones that has not been depleted to one of the producing zones that has been depleted.

A system for extracting materials from a plurality of producing subterranean zones in a wellbore, at least a portion of the wellbore including a casing, has also been described that includes means for positioning one or more solid tubulars within the wellbore, means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zones, means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, means for fluidicly coupling the solid tubulars with the casing, means for fluidicly coupling the perforated tubulars with the solid tubulars, means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, means for positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars, and means for preventing fluids from passing from one of the producing zones that has not been depleted to one of the producing zones that has been depleted.

An apparatus for extracting geothermal energy from a subterranean formation containing a source of geothermal energy has also been described that includes a zonal isolation assembly positioned within the subterranean formation including: one or more solid tubular members, each solid tubular member including one or more external seals, one or more perforated tubular members each including radial passages coupled to the solid tubular members, and one or more perforated tubular liners each including one or more radial passages coupled to the interior surfaces of one or more of the perforated tubular members, and a shoe coupled to the zonal isolation assembly. At least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore.

A method of isolating a first subterranean zone from a second subterranean zone including a source of geothermal energy in a wellbore has also been described that includes positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone, radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, fluidicly coupling the perforated tubulars and the primary solid tubulars, preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars, positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars, and radially expanding and plastically deforming the perforated tubular liners within the interior of one or more of the perforated tubulars.

A method of extracting geothermal energy from a subterranean geothermal zone in a wellbore, at least a portion of the wellbore including a casing, has also been described that includes positioning one or more solid tubulars within the wellbore, positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the subterranean geothermal zone, radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, fluidicly coupling the solid tubulars with the casing, fluidicly coupling the perforated tubulars with the solid tubulars, fluidicly isolating the subterranean geothermal zone from at least one other subterranean zone within the wellbore, and fluidicly coupling at least one of the perforated tubulars with the subterranean geothermal zone.

A system for isolating a first subterranean zone from a second geothermal subterranean zone in a wellbore has also been described that includes means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second geothermal subterranean zone, means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, means for fluidicly coupling the perforated tubulars and the solid tubulars, and means for

preventing the passage of fluids from the first subterranean zone to the second geothermal subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars.

A system for extracting geothermal energy from a subterranean geothermal zone in a wellbore, at least a portion of the wellbore including a casing, has also been described that includes means for positioning one or more solid tubulars within the wellbore, means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the subterranean geothermal zone, means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, means for fluidicly coupling the solid tubulars with the casing, means for fluidicly coupling the perforated tubulars with the solid tubulars, means for fluidicly isolating the subterranean geothermal zone from at least one other subterranean zone within the wellbore, and means for fluidicly coupling at least one of the perforated tubulars with the subterranean geothermal zone.

An apparatus has also been described that includes a zonal isolation assembly including: one or more solid tubular members, each solid tubular member including one or more external seals, one or more perforated tubular members each including one or more radial passages coupled to the solid tubular members, and a shoe coupled to the zonal isolation assembly. At least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore, and the radial passage of at least one of the perforated tubular members are cleaned by further radial expansion of the perforated tubular members within the wellbore.

A method of isolating a first subterranean zone from a second subterranean zone in a wellbore has also been described that includes positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the second subterranean zone, radially expanding at least one of the primary solid tubulars and perforated tubulars within the wellbore, fluidicly coupling the perforated tubulars and the solid tubulars, preventing the passage of fluids from the first subterranean zone to the second subterranean zone

within the wellbore external to the solid tubulars and perforated tubulars, and cleaning materials from the radial passages of at least one of the perforated tubulars by further radial expansion of the perforated tubulars within the wellbore.

A method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, has also been described that includes positioning one or more solid tubulars within the wellbore, positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the producing subterranean zone, radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, fluidicly coupling the solid tubulars with the casing, fluidicly coupling the perforated tubulars with the solid tubulars, fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, monitoring the operating temperatures, pressures, and flow rates within one or more of the perforated tubulars, and cleaning materials from the radial passages of at least one of the perforated tubulars by further radial expansion of the perforated tubulars within the wellbore.

A system for isolating a first subterranean zone from a second subterranean zone in a wellbore has also been described that includes means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone, means for positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the second subterranean zone, means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, means for fluidicly coupling the perforated tubulars and the solid tubulars, means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars, and means for cleaning materials from the radial passages of at least one of the perforated tubulars by further radial expansion of the perforated tubulars within the wellbore.

A system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, has also been described that includes means for positioning one or more solid tubulars within the wellbore, means for

positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the producing subterranean zone, means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, means for fluidicly coupling the solid tubulars with the casing, means for fluidicly coupling the perforated tubulars with the solid tubulars, means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore, means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone, and means for cleaning materials from the radial passages of at least one of the perforated tubulars by further radial expansion of the perforated tubulars within the wellbore.

Although illustrative embodiments of the invention have been shown and described, a wide range of modification, changes and substitution is contemplated in the foregoing disclosure. In some instances, some features of the present invention may be employed without a corresponding use of the other features. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the scope of the invention.

CLAIMS

1. An apparatus, comprising:

a zonal isolation assembly comprising:

one or more solid tubular members, each solid tubular member including one or more external seals;

one or more perforated tubular members coupled to the solid tubular members, the perforated tubular members defining a longitudinal flow passage;

one or more flow control valves operably coupled to the perforated tubular members for controlling the flow of fluidic materials through the perforated tubular members;

one or more temperature sensors located within the longitudinal flow passage of one or more of the perforated tubular members for monitoring the operating temperature within the perforated tubular members;

one or more pressure sensors located within the longitudinal flow passage of one or more of the perforated tubular members for monitoring the operating pressure within the perforated tubular members; and

one or more flow sensors located within the longitudinal flow passage of one or more of the perforated tubular members for monitoring the operating flow rate within the perforated tubular members; and

a shoe coupled to the zonal isolation assembly; and

a controller operably coupled to the flow control valves, the temperature sensors, the pressure sensors, and the flow sensors for monitoring the temperature, pressure and flow sensors and controlling the operation of the flow control valves; and

wherein at least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore; and

an expansion device adapted to radially expand at least one of the solid tubular members or at least one of the perforated tubular members.

2. A method of isolating a first subterranean zone from a second subterranean zone in a wellbore, comprising:

positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the second subterranean zone, the perforated tubular members defining a longitudinal flow passage;

radially expanding at least one of the primary solid tubulars and perforated tubulars within the wellbore, with an expansion device comprising a first conical outer surface and a second conical outer surface;

fluidicly coupling the perforated tubulars and the solid tubulars;

preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars;

monitoring the operating temperatures, pressures, and flow rates within the longitudinal flow passage of one or more of the perforated tubulars; and

controlling the flow of fluidic materials through the perforated tubulars as a function of the monitored operating temperatures, pressures, and flow rates.

3. A method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, comprising;

positioning one or more solid tubulars within the wellbore;

positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the producing subterranean zone, the perforated tubular members defining a longitudinal flow passage;

radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, with an expansion device comprising a first conical outer surface and a second conical outer surface;

fluidicly coupling the solid tubulars with the casing;

fluidicly coupling the perforated tubulars with the solid tubulars;

fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore;

fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone;

monitoring the operating temperatures, pressures, and flow rates within the longitudinal flow passage of one or more of the perforated tubulars; and

controlling the flow of fluidic materials through the perforated tubulars as a function of the monitored operating temperatures, pressures, and flow rates.

4. A system for isolating a first subterranean zone from a second subterranean zone in a wellbore, comprising:

means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

means for positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the second subterranean zone, the perforated tubular members defining a longitudinal flow passage;

means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, comprising a first conical outer surface and a second conical outer surface;

means for fluidicly coupling the perforated tubulars and the solid tubulars;

means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars;

means for monitoring the operating temperatures, pressures, and flow rates within the longitudinal flow passage of one or more of the perforated tubulars; and

means for controlling the flow of fluidic materials through the perforated tubulars as a function of the monitored operating temperatures, pressures, and flow rates.

5. A system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, comprising;

means for positioning one or more solid tubulars within the wellbore;

means for positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the producing subterranean zone, the perforated tubular members defining a longitudinal flow passage;

means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, comprising a first conical outer surface and a second conical outer surface;

means for fluidicly coupling the solid tubulars with the casing;

means for fluidicly coupling the perforated tubulars with the solid tubulars;

means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore;

means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone;

means for monitoring the operating temperatures, pressures, and flow rates within the longitudinal flow passage of one or more of the perforated tubulars; and

means for controlling the flow of fluidic materials through the perforated tubulars as a function of the monitored operating temperatures, pressures, and flow rates.

6. An apparatus, comprising:

a zonal isolation assembly comprising:

one or more solid tubular members, each solid tubular member including one or more external seals;

one or more perforated tubular members coupled to the solid tubular members, the perforated tubular members defining a longitudinal flow passage;

one or more flow control valves operably coupled to the perforated tubular members for controlling the flow of fluidic materials through the perforated tubular members;

one or more temperature sensors located within the longitudinal flow passage of one or more of the perforated tubular members for monitoring the operating temperature within the perforated tubular members;

one or more pressure sensors located within the longitudinal flow passage of one or more of the perforated tubular members for monitoring the operating pressure within the perforated tubular members; and

one or more flow sensors located within the longitudinal flow passage of one or more of the perforated tubular members for monitoring the operating flow rate within the perforated tubular members; and

a shoe coupled to the zonal isolation assembly; and

a controller operably coupled to the flow control valves, the temperature sensors, the pressure sensors, and the flow sensors for monitoring the temperature, pressure and flow sensors and controlling the operation of the flow control valves;

an expansion device comprising a first conical outer surface and a second conical outer surface adapted to radially expand at least one of the solid tubular members or at least one of the perforated tubular members.

7. The apparatus of claim 1, wherein the expansion device comprises an expansion cone.

8. The apparatus of claim 1, wherein the expansion device comprises an expandable expansion device.

9. The apparatus of claim 1, wherein the expansion device is adapted to operate under fluid pressure.

10. The apparatus of claim 1, wherein the expansion device comprises a parabolic expansion device.

11. The apparatus of claim 1, wherein the expansion device comprises a first conical outer surface and a second conical outer surface.

12. The apparatus of claim 1, wherein the expansion device comprises at least three adjacent conical outer surfaces.

13. The apparatus of claim 11, wherein the first conical outer surface comprises an angle of attack between about 8° and about 20°.

14. The apparatus of claim 11 or 13, wherein the second conical outer surface comprises an angle of attack between about 4° and about 15°.

15. The apparatus of any one of claims 11-14, wherein the angle of attack decreases from a front end of the expansion device to a back end of the expansion device.

16. The apparatus of claim 1 or 6, wherein at least one of the solid tubular members and at least one of the perforated tubular members are coupled with a threaded connection.

17. The apparatus of claim 16, wherein the threaded connection is radially expanded within the wellbore.

18. The method of claim 2, wherein the radially expanding comprises an expansion device.

19. The method of claim 18, wherein the expansion device comprises an expansion cone.

20. The method of claim 18, wherein the expansion device comprises an expandable expansion device.

21. The method of claim 18, wherein the expansion device is adapted to operate under fluid pressure.

22. The method of claim 18, wherein the expansion device comprises a parabolic expansion device.

23. The method of claim 18, wherein the expansion device comprises a first conical outer surface and a second conical outer surface.

24. The method of claim 18, wherein the expansion device comprises at least three adjacent conical outer surfaces.

25. The method of claim 23, wherein the first conical outer surface comprises an angle of attack between about 8° and about 20°.

26. The method of claim 23 or 25, wherein the second conical outer surface comprises an angle of attack between about 4° and about 15°.

27. The method of any one of claims 23-26, wherein the angle of attack decreases from a front end of the expansion device to a back end of the expansion device.

28. The method of claim 2, wherein at least one of the solid tubular members and at least one of the perforated tubular members are coupled with a threaded connection.

29. The method of claim 28, wherein the threaded connection is radially expanded within the wellbore.

30. The method of claim 3, wherein the radially expanding comprises an expansion device.

31. The method of claim 30, wherein the expansion device comprises an expansion cone.

32. The method of claim 30, wherein the expansion device comprises an expandable expansion device.

33. The method of claim 30, wherein the expansion device is adapted to operate under fluid pressure.

34. The method of claim 30, wherein the expansion device comprises a parabolic expansion device.

35. The method of claim 30, wherein the expansion device comprises a first conical outer surface and a second conical outer surface.

36. The method of claim 30, wherein the expansion device comprises at least three adjacent conical outer surfaces.

37. The method of claim 35, wherein the first conical outer surface comprises an angle of attack between about 8° and about 20°.

38. The method of claim 35 or 37, wherein the second conical outer surface comprises an angle of attack between about 4° and about 15°.

39. The method of any one of claims 35-38, wherein the angle of attack decreases from a front end of the expansion device to a back end of the expansion device.

40. The method of claim 3, wherein at least one of the solid tubular members and at least one of the perforated tubular members are coupled with a threaded connection.

41. The method of claim 40, wherein the threaded connection is radially expanded within the wellbore.

42. The system of claim 4, wherein the means for radially expanding comprises an expansion device adapted to radially expand at least one of the solid tubular members or at least one of the perforated tubular members.

43. The system of claim 42, wherein the expansion device comprises an expansion cone.

44. The system of claim 42, wherein the expansion device comprises an expandable expansion device.

45. The system of claim 42, wherein the expansion device is adapted to operate under fluid pressure.

46. The system of claim 42, wherein the expansion device comprises a parabolic expansion device.

47. The system of claim 42, wherein the expansion device comprises a first conical outer surface and a second conical outer surface.

48. The system of claim 42, wherein the expansion device comprises at least three adjacent conical outer surfaces.

49. The system of claim 47, wherein the first conical outer surface comprises an angle of attack between about 8° and about 20°.

50. The system of claim 47 or 49, wherein the second conical outer surface comprises an angle of attack between about 4° and about 15°.

51. The system of any one of claims 47-50, wherein the angle of attack decreases from a front end of the expansion device to a back end of the expansion device.

52. The system of claim 4, wherein at least one of the solid tubular members and at least one of the perforated tubular members are coupled with a threaded connection.

53. The system of claim 52, wherein the threaded connection is radially expanded within the wellbore.

54. The system of claim 5, wherein the means for radially expanding comprises an expansion device adapted to radially expand at least one of the solid tubular members or at least one of the perforated tubular members.

55. The system of claim 54, wherein the expansion device comprises an expansion cone.

56. The system of claim 54, wherein the expansion device comprises an expandable expansion device.

57. The system of claim 54, wherein the expansion device is adapted to operate under fluid pressure.

58. The system of claim 54, wherein the expansion device comprises a parabolic expansion device.

59. The system of claim 54, wherein the expansion device comprises a first conical outer surface and a second conical outer surface.

60. The system of claim 54, wherein the expansion device comprises at least three adjacent conical outer surfaces.

61. The system of claim 59, wherein the first conical outer surface comprises an angle of attack between about 8° and about 20°.

62. The system of claim 59 or 61, wherein the second conical outer surface comprises an angle of attack between about 4° and about 15°.

63. The system of any one of claims 59-62, wherein the angle of attack decreases from a front end of the expansion device to a back end of the expansion device.

64. The system of claim 5, wherein at least one of the solid tubular members and at least one of the perforated tubular members are coupled with a threaded connection.

65. The system of claim 64, wherein the threaded connection is radially expanded within the wellbore.

1. An apparatus, comprising:

a zonal isolation assembly comprising:

one or more solid tubular members, each solid tubular member including one or more external seals;

one or more perforated tubular members coupled to the solid tubular members; one or more flow control valves operably coupled to the perforated tubular members for controlling the flow of fluidic materials through the perforated tubular members;

one or more temperature sensors operably coupled to one or more of the perforated tubular members for monitoring the operating temperature within the perforated tubular members;

one or more pressure sensors operably coupled to one or more of the perforated tubular members for monitoring the operating pressure within the perforated tubular members; and

one or more flow sensors operably coupled to one or more of the perforated tubular members for monitoring the operating flow rate within the perforated tubular members; and

a shoe coupled to the zonal isolation assembly; and

a controller operably coupled to the flow control valves, the temperature sensors, the pressure sensors, and the flow sensors for monitoring the temperature, pressure and flow sensors and controlling the operation of the flow control valves;

wherein at least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore.

2. A method of isolating a first subterranean zone from a second subterranean zone in a wellbore, comprising:

positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the second subterranean zone;

radially expanding at least one of the primary solid tubulars and perforated tubulars within the wellbore;

fluidicly coupling the perforated tubulars and the solid tubulars;

preventing the passage of fluids from the first subterranean zone to the second

subterranean zone within the wellbore external to the solid tubulars and perforated tubulars;

monitoring the operating temperatures, pressures, and flow rates within one or more of the perforated tubulars; and

controlling the flow of fluidic materials through the perforated tubulars as a function of the monitored operating temperatures, pressures, and flow rates.

3. A method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, comprising;

positioning one or more solid tubulars within the wellbore;

positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the producing subterranean zone;

radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore;

fluidicly coupling the solid tubulars with the casing;

fluidicly coupling the perforated tubulars with the solid tubulars;

fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore;

fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone;

monitoring the operating temperatures, pressures, and flow rates within one or more of the perforated tubulars; and

controlling the flow of fluidic materials through the perforated tubulars as a function of the monitored operating temperatures, pressures, and flow rates.

4. A system for isolating a first subterranean zone from a second subterranean zone in a wellbore, comprising:

means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

means for positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the second subterranean zone;

means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore;

means for fluidicly coupling the perforated tubulars and the solid tubulars;

means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars;

means for monitoring the operating temperatures, pressures, and flow rates within one or more of the perforated tubulars; and

means for controlling the flow of fluidic materials through the perforated tubulars as a function of the monitored operating temperatures, pressures, and flow rates.

5. A system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, comprising;

means for positioning one or more solid tubulars within the wellbore;

means for positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the producing subterranean zone;

means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore;

means for fluidicly coupling the solid tubulars with the casing;

means for fluidicly coupling the perforated tubulars with the solid tubulars;

means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore;

means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone;

means for monitoring the operating temperatures, pressures, and flow rates within one or more of the perforated tubulars; and

means for controlling the flow of fluidic materials through the perforated tubulars as a function of the monitored operating temperatures, pressures, and flow rates.

6. An apparatus, comprising:

a zonal isolation assembly comprising:

one or more solid tubular members, each solid tubular member including one or more external seals;

one or more perforated tubular members each including radial passages coupled to the solid tubular members; and

one or more solid tubular liners coupled to the interior surfaces of one or more

of the perforated tubular members for sealing at least some of the radial passages of the perforated tubular members; and

a shoe coupled to the zonal isolation assembly;

wherein at least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore; and

wherein the solid tubular liners are formed by a radial expansion process performed within the wellbore.

7. A method of isolating a first subterranean zone from a second subterranean zone in a wellbore, comprising:

positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone;

radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore;

fluidicly coupling the perforated tubulars and the primary solid tubulars;

preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars;

positioning one or more solid tubular liners within the interior of one or more of the perforated tubulars; and

radially expanding and plastically deforming the solid tubular liners within the interior of one or more of the perforated tubulars to fluidicly seal at least some of the radial passages of the perforated tubulars.

8. A method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, comprising;

positioning one or more solid tubulars within the wellbore;

positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zone;

radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore;

fluidicly coupling the solid tubulars with the casing;

fluidicly coupling the perforated tubulars with the solid tubulars;

fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore;

fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone;

positioning one or more solid tubular liners within the interior of one or more of the perforated tubulars; and

radially expanding and plastically deforming the solid tubular liners within the interior of one or more of the perforated tubulars to fluidicly seal at least some of the radial passages of the perforated tubulars.

9. A system for isolating a first subterranean zone from a second subterranean zone in a wellbore, comprising:

means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone;

means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore;

means for fluidicly coupling the perforated tubulars and the solid tubulars;

means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars;

means for positioning one or more solid tubular liners within the interior of one or more of the perforated tubulars; and

means for radially expanding and plastically deforming the solid tubular liners within the interior of one or more of the perforated tubulars to fluidicly seal at least some of the radial passages of the perforated tubulars.

10. A system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, comprising;

means for positioning one or more solid tubulars within the wellbore;

means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zone;

means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore;

means for fluidicly coupling the solid tubulars with the casing;

means for fluidicly coupling the perforated tubulars with the solid tubulars;

means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore;

means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone;

means for positioning one or more solid tubular liners within the interior of one or more of the perforated tubulars; and

means for radially expanding and plastically deforming the solid tubular liners within the interior of one or more of the perforated tubulars to fluidicly seal at least some of the radial passages of the perforated tubulars.

11. An apparatus, comprising:

a zonal isolation assembly comprising:

one or more solid tubular members, each solid tubular member including one or more external seals;

one or more perforated tubular members each including radial passages coupled to the solid tubular members; and

a sealing material coupled to at least some of the perforated tubular members for sealing at least some of the radial passages of the perforated tubular members; and

a shoe coupled to the zonal isolation assembly.

12. A method of isolating a first subterranean zone from a second subterranean zone in a wellbore, comprising:

positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone;

radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore;

fluidicly coupling the perforated tubulars and the primary solid tubulars;

preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars;

sealing off an annular region within at least one of the perforated tubulars; and

injecting a hardenable fluidic sealing material into the sealed annular regions of the perforated tubulars to seal off at least some of the radial passages of the perforated tubulars.

13. A method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, comprising;

positioning one or more solid tubulars within the wellbore;

positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zone;

radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore;

fluidicly coupling the solid tubulars with the casing;

fluidicly coupling the perforated tubulars with the solid tubulars;

fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore;

fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone;

sealing off an annular region within at least one of the perforated tubulars; and

injecting a hardenable fluidic sealing material into the sealed annular regions of the perforated tubulars to seal off at least some of the radial passages of the perforated tubulars.

14. A system for isolating a first subterranean zone from a second subterranean zone in a wellbore, comprising:

means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone;

means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore;

means for fluidicly coupling the perforated tubulars and the solid tubulars;

means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars;

means for sealing off an annular region within at least one of the perforated tubulars; and

means for injecting a hardenable fluidic sealing material into the sealed annular regions of the perforated tubulars to seal off at least some of the radial passages of the perforated tubulars.

15. A system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, comprising;

means for positioning one or more solid tubulars within the wellbore;

means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zone;

means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore;

means for fluidicly coupling the solid tubulars with the casing;

means for fluidicly coupling the perforated tubulars with the solid tubulars;

means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore;

means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone;

means for sealing off an annular region within at least one of the perforated tubulars; and

means for injecting a hardenable fluidic sealing material into the sealed annular regions of the perforated tubulars to seal off at least some of the radial passages of the perforated tubulars.

16. An apparatus, comprising:

a zonal isolation assembly positioned within a wellbore that traverses a subterranean formation, comprising:

one or more solid tubular members, each solid tubular member including one or more external seals;

one or more perforated tubular members coupled to the solid tubular members; and

a shoe coupled to the zonal isolation assembly;

wherein at least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore; and

wherein at least one of the perforated tubular members are radially expanded into intimate contact with the subterranean formation.

17. The apparatus of claim 16, wherein the perforated tubular members that are radially expanded into intimate contact with the subterranean formation compress the subterranean formation.

18. A method of isolating a first subterranean zone from a second subterranean zone in a wellbore, comprising:

positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the second subterranean zone;

radially expanding at least one of the primary solid tubulars and perforated tubulars within the wellbore;

radially expanding at least one of the perforated tubulars into intimate contact with the second subterranean zone;

fluidicly coupling the perforated tubulars and the solid tubulars; and

preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars.

19. The method of claim 18, wherein the perforated tubulars that are radially expanded into intimate contact with the second subterranean zone compress the second subterranean zone.

20. The method of claim 18, further comprising vibrating the second subterranean zone to increase the rate of recovery of hydrocarbons from the second subterranean zone.

21. The method of claim 18, further comprising vibrating the second subterranean zone to clean the radial passages of the perforated tubulars that are radially expanded into intimate contact with the second subterranean zone.

22. The method of claim 18, further comprising applying an impulsive load to the perforated tubulars that are radially expanded into intimate contact with the second subterranean zone to increase the rate of recovery of hydrocarbons from the second subterranean zone.

23. A method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, comprising;

positioning one or more solid tubulars within the wellbore;

positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the producing subterranean zone;

radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore;

radially expanding at least one of the perforated tubulars into intimate contact with the producing subterranean zone;

fluidicly coupling the solid tubulars with the casing;

fluidicly coupling the perforated tubulars with the solid tubulars;

fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore; and

fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone.

24. The method of claim 23, wherein the perforated tubulars that are radially expanded into intimate contact with the producing subterranean zone compress the producing subterranean zone.

25. The method of claim 23, further comprising vibrating the producing subterranean zone to increase the rate of recovery of hydrocarbons from the producing subterranean zone.

26. The method of claim 23, further comprising vibrating the producing subterranean zone to clean the radial passages of the perforated tubulars that are radially expanded into intimate contact with the producing subterranean zone.

27. The method of claim 23, further comprising applying an impulsive load to the perforated tubulars that are radially expanded into intimate contact with the producing subterranean zone to increase the rate of recovery of hydrocarbons from the producing subterranean zone.

28. A system for isolating a first subterranean zone from a second subterranean zone in a wellbore, comprising:

means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

means for positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the second subterranean zone;

means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore;

means for radially expanding at least one of the perforated tubulars into intimate contact with the second subterranean zone;

means for fluidicly coupling the perforated tubulars and the solid tubulars; and

means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars.

29. The system of claim 28, wherein the means for radially expanding at least one of the perforated tubulars into intimate contact with the second subterranean zone comprises means for compressing the second subterranean zone.

30. The system of claim 28, further comprising means for vibrating the second subterranean zone to increase the rate of recovery of hydrocarbons from the second subterranean zone.

31. The system of claim 28, further comprising means for vibrating the second subterranean zone to clean the radial passages of the perforated tubulars that are radially expanded into intimate contact with the second subterranean zone.

32. The system of claim 28, further comprising means for applying an impulsive load to the perforated tubulars that are radially expanded into intimate contact with the second subterranean zone to increase the rate of recovery of hydrocarbons from the second subterranean zone.

33. A system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, comprising;

means for positioning one or more solid tubulars within the wellbore;

means for positioning one or more perforated tubulars within the wellbore each including one or more radial openings, the perforated tubulars traversing the producing subterranean zone;

means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore;

means for radially expanding at least one of the perforated tubulars into intimate contact with the producing subterranean zone;

means for fluidicly coupling the solid tubulars with the casing;

means for fluidicly coupling the perforated tubulars with the solid tubulars;

means for fluidicly isolating the producing subterranean zone from at least one

other subterranean zone within the wellbore; and

means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone.

34. The system of claim 33, wherein the means for radially expanding at least one of the perforated tubulars into intimate contact with the producing subterranean zone comprises means for compressing the producing subterranean zone.

35. The system of claim 33, further comprising means for vibrating the producing subterranean zone to increase the rate of recovery of hydrocarbons from the producing subterranean zone.

36. The system of claim 33, further comprising means for vibrating the producing subterranean zone to clean the radial passages of the perforated tubulars that are radially expanded into intimate contact with the producing subterranean zone.

37. The system of claim 33, further comprising means for applying an impulsive load to the perforated tubulars that are radially expanded into intimate contact with the producing subterranean zone to increase the rate of recovery of hydrocarbons from the producing subterranean zone.

38. An apparatus, comprising:

a zonal isolation assembly positioned within a wellbore that traverses a subterranean formation and includes a perforated wellbore casing, comprising:

one or more solid tubular members, each solid tubular member including one or more external seals;

one or more perforated tubular members coupled to the solid tubular members; and

a shoe coupled to the zonal isolation assembly;

wherein at least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore; and

wherein at least one of the perforated tubular members are radially expanded into intimate contact with the perforated wellbore casing.

39. The apparatus of claim 38, wherein the perforated tubular members that are radially expanded into intimate contact with the perforated casing compress the subterranean formation.

40. A method of isolating a first subterranean zone from a second subterranean zone in a wellbore that includes a perforated casing that traverses the second subterranean zone, comprising:

positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the second subterranean zone;

radially expanding at least one of the primary solid tubulars and perforated tubulars within the wellbore;

radially expanding at least one of the perforated tubulars into intimate contact with the perforated casing;

fluidicly coupling the perforated tubulars and the solid tubulars; and

preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars.

41. The method of claim 40, wherein the perforated tubulars that are radially expanded into intimate contact with the perforated casing compress the second subterranean zone.

42. The method of claim 40, further comprising vibrating the second subterranean zone to increase the rate of recovery of hydrocarbons from the second subterranean zone.

43. The method of claim 40, further comprising vibrating the second subterranean zone to clean the radial passages of the perforated tubulars that are radially expanded into intimate contact with the perforated casing.

44. The method of claim 40, further comprising applying an impulsive load to the

perforated tubulars that are radially expanded into intimate contact with the perforated casing to increase the rate of recovery of hydrocarbons from the second subterranean zone.

45. A method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing and a perforated casing that traverses the producing subterranean zone, comprising;

positioning one or more solid tubulars within the wellbore;

positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the producing subterranean zone;

radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore;

radially expanding at least one of the perforated tubulars into intimate contact with the perforated casing;

fluidicly coupling the solid tubulars with the casing;

fluidicly coupling the perforated tubulars with the solid tubulars;

fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore; and

fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone.

46. The method of claim 45, wherein the perforated tubulars that are radially expanded into intimate contact with the perforated casing compress the producing subterranean zone.

47. The method of claim 45, further comprising vibrating the producing subterranean zone to increase the rate of recovery of hydrocarbons from the producing subterranean zone.

48. The method of claim 45, further comprising vibrating the producing subterranean zone to clean the radial passages of the perforated tubulars that are radially expanded into intimate contact with the perforated casing.

49. The method of claim 45, further comprising applying an impulsive load to the perforated tubulars that are radially expanded into intimate contact with the perforated tubulars to increase the rate of recovery of hydrocarbons from the producing subterranean zone.

50. A system for isolating a first subterranean zone from a second subterranean zone in a wellbore that includes a perforated casing that traverses the second subterranean zone, comprising:

means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

means for positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the second subterranean zone;

means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore;

means for radially expanding at least one of the perforated tubulars into intimate contact with the perforated casing;

means for fluidicly coupling the perforated tubulars and the solid tubulars; and

means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars.

51. The system of claim 50, wherein the means for radially expanding at least one of the perforated tubulars into intimate contact with the perforated casing comprises

means for compressing the second subterranean zone.

52. The system of claim 50, further comprising means for vibrating the second subterranean zone to increase the rate of recovery of hydrocarbons from the second subterranean zone.

53. The system of claim 50, further comprising means for vibrating the second subterranean zone to clean the radial passages of the perforated tubulars that are radially expanded into intimate contact with the perforated casing.

54. The system of claim 50, further comprising means for applying an impulsive load to the perforated tubulars that are radially expanded into intimate contact with the perforated casing to increase the rate of recovery of hydrocarbons from the second subterranean zone.

55. A system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing and a perforated casing that traverses the producing subterranean zone, comprising;

means for positioning one or more solid tubulars within the wellbore;

means for positioning one or more perforated tubulars within the wellbore each including one or more radial openings, the perforated tubulars traversing the producing subterranean zone;

means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore;

means for radially expanding at least one of the perforated tubulars into intimate contact with the perforated casing;

means for fluidicly coupling the solid tubulars with the casing;

means for fluidicly coupling the perforated tubulars with the solid tubulars;

means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore; and

means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone.

56. The system of claim 55, wherein the means for radially expanding at least one of the perforated tubulars into intimate contact with the perforated casing comprises means for compressing the producing subterranean zone.

57. The system of claim 55, further comprising means for vibrating the producing subterranean zone to increase the rate of recovery of hydrocarbons from the producing subterranean zone.

58. The system of claim 55, further comprising means for vibrating the producing subterranean zone to clean the radial passages of the perforated tubulars that are radially expanded into intimate contact with the perforated casing.

59. The system of claim 55, further comprising means for applying an impulsive load to the perforated tubulars that are radially expanded into intimate contact with the perforated casing to increase the rate of recovery of hydrocarbons from the producing subterranean zone.

60. An apparatus, comprising:

a zonal isolation assembly comprising:

one or more solid tubular members, each solid tubular member including one or more external seals;

one or more perforated tubular members each including radial passages coupled to the solid tubular members; and

one or more perforated tubular liners each including one or more radial passages coupled to the interior surfaces of one or more of the perforated tubular members; and

a shoe coupled to the zonal isolation assembly;

wherein at least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore; and

wherein the perforated tubular liners are formed by a radial expansion process performed within the wellbore.

61. A method of isolating a first subterranean zone from a second subterranean zone in a wellbore, comprising:

positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone;

radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore;

fluidicly coupling the perforated tubulars and the primary solid tubulars;

preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars;

positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars; and

radially expanding and plastically deforming the perforated tubular liners within the interior of one or more of the perforated tubulars.

62. A method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, comprising;

positioning one or more solid tubulars within the wellbore;

positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zone;

radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore;

fluidicly coupling the solid tubulars with the casing;

fluidicly coupling the perforated tubulars with the solid tubulars;

fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore;

fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone;

positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars; and

radially expanding and plastically deforming the perforated tubular liners within the interior of one or more of the perforated tubulars.

63. A system for isolating a first subterranean zone from a second subterranean zone in a wellbore, comprising:

means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone;

means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore;

means for fluidicly coupling the perforated tubulars and the solid tubulars;

means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars;

means for positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars; and

means for radially expanding and plastically deforming the perforated tubular liners within the interior of one or more of the perforated tubulars.

64. A system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, comprising;

means for positioning one or more solid tubulars within the wellbore;

means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zone;

means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore;

means for fluidicly coupling the solid tubulars with the casing;

means for fluidicly coupling the perforated tubulars with the solid tubulars;

means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore;

means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone;

means for positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars; and

means for radially expanding and plastically deforming the perforated tubular liners within the interior of one or more of the perforated tubulars.

65. An apparatus, comprising:

a zonal isolation assembly comprising:

one or more solid tubular members, each solid tubular member including one or more external seals;

two or more perforated tubular members each including radial passages coupled to the solid tubular members; and

one or more one-way valves for controllably fluidicly coupling the perforated

tubular members; and

a shoe coupled to the zonal isolation assembly;

wherein at least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore.

66. A method of isolating a first subterranean zone from a second subterranean zone having a plurality of producing zones in a wellbore, comprising:

positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

positioning two or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone;

radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore;

fluidicly coupling the perforated tubulars and the primary solid tubulars;

preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars; and

preventing fluids from passing from one of the producing zones that has not been depleted to one of the producing zones that has been depleted.

67. A method of extracting materials from a wellbore having a plurality of producing subterranean zones, at least a portion of the wellbore including a casing, comprising;

positioning one or more solid tubulars within the wellbore;

positioning two or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zones;

radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore;

fluidicly coupling the solid tubulars with the casing;

fluidicly coupling the perforated tubulars with the solid tubulars;

fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore;

fluidicly coupling at least one of the perforated tubulars with the producing

subterranean zone;

preventing fluids from passing from one of the producing zones that has not been depleted to one of the producing zones that has been depleted.

68. A system for isolating a first subterranean zone from a second subterranean zone having a plurality of producing zones in a wellbore, comprising:

means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone;

means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore;

means for fluidicly coupling the perforated tubulars and the solid tubulars;

means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars;

means for positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars; and

means for preventing fluids from passing from one of the producing zones that has not been depleted to one of the producing zones that has been depleted.

69. A system for extracting materials from a plurality of producing subterranean zones in a wellbore, at least a portion of the wellbore including a casing, comprising;

means for positioning one or more solid tubulars within the wellbore;

means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the producing subterranean zones;

means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore;

means for fluidicly coupling the solid tubulars with the casing;

means for fluidicly coupling the perforated tubulars with the solid tubulars;

means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore;

means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone;

means for positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars; and

means for preventing fluids from passing from one of the producing zones that has not been depleted to one of the producing zones that has been depleted.

70. An apparatus for extracting geothermal energy from a subterranean formation containing a source of geothermal energy, comprising:

a zonal isolation assembly positioned within the subterranean formation, comprising:

one or more solid tubular members, each solid tubular member including one or more external seals;

one or more perforated tubular members each including radial passages coupled to the solid tubular members; and

one or more perforated tubular liners each including one or more radial passages coupled to the interior surfaces of one or more of the perforated tubular members; and

a shoe coupled to the zonal isolation assembly;

wherein at least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore.

71. A method of isolating a first subterranean zone from a second subterranean zone including a source of geothermal energy in a wellbore, comprising:

positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second subterranean zone;

radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore;

fluidicly coupling the perforated tubulars and the primary solid tubulars;

preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the primary solid tubulars and

perforated tubulars; and

positioning one or more perforated tubular liners within the interior of one or more of the perforated tubulars; and

radially expanding and plastically deforming the perforated tubular liners within the interior of one or more of the perforated tubulars.

72. A method of extracting geothermal energy from a subterranean geothermal zone in a wellbore, at least a portion of the wellbore including a casing, comprising;

positioning one or more solid tubulars within the wellbore;

positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the subterranean geothermal zone;

radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore;

fluidicly coupling the solid tubulars with the casing;

fluidicly coupling the perforated tubulars with the solid tubulars;

fluidicly isolating the subterranean geothermal zone from at least one other subterranean zone within the wellbore; and

fluidicly coupling at least one of the perforated tubulars with the subterranean geothermal zone.

73. A system for isolating a first subterranean zone from a second geothermal subterranean zone in a wellbore, comprising:

means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the second geothermal subterranean zone;

means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore;

means for fluidicly coupling the perforated tubulars and the solid tubulars; and

means for preventing the passage of fluids from the first subterranean zone to the second geothermal subterranean zone within the wellbore external to the primary solid tubulars and perforated tubulars.

74. A system for extracting geothermal energy from a subterranean geothermal zone in a wellbore, at least a portion of the wellbore including a casing, comprising;

means for positioning one or more solid tubulars within the wellbore;

means for positioning one or more perforated tubulars each including one or more radial passages within the wellbore, the perforated tubulars traversing the subterranean geothermal zone;

means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore;

means for fluidicly coupling the solid tubulars with the casing;

means for fluidicly coupling the perforated tubulars with the solid tubulars;

means for fluidicly isolating the subterranean geothermal zone from at least one other subterranean zone within the wellbore; and

means for fluidicly coupling at least one of the perforated tubulars with the subterranean geothermal zone.

75. An apparatus, comprising:

a zonal isolation assembly comprising:

one or more solid tubular members, each solid tubular member including one or more external seals;

one or more perforated tubular members each including one or more radial passages coupled to the solid tubular members; and

a shoe coupled to the zonal isolation assembly;

wherein at least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within the wellbore; and

wherein the radial passage of at least one of the perforated tubular members are cleaned by further radial expansion of the perforated tubular members within the wellbore.

76. A method of isolating a first subterranean zone from a second subterranean zone in a wellbore, comprising:

positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the second subterranean zone;

radially expanding at least one of the primary solid tubulars and perforated tubulars within the wellbore;

fluidicly coupling the perforated tubulars and the solid tubulars;

preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars; and

cleaning materials from the radial passages of at least one of the perforated tubulars by further radial expansion of the perforated tubulars within the wellbore.

77. A method of extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, comprising;

positioning one or more solid tubulars within the wellbore;

positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the producing subterranean zone;

radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore;

fluidicly coupling the solid tubulars with the casing;

fluidicly coupling the perforated tubulars with the solid tubulars;

fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore;

fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone;

monitoring the operating temperatures, pressures, and flow rates within one or more of the perforated tubulars; and

cleaning materials from the radial passages of at least one of the perforated tubulars by further radial expansion of the perforated tubulars within the wellbore.

78. A system for isolating a first subterranean zone from a second subterranean zone in a wellbore, comprising:

means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

means for positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the second subterranean zone;

means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore;

means for fluidicly coupling the perforated tubulars and the solid tubulars;

means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars; and

means for cleaning materials from the radial passages of at least one of the perforated tubulars by further radial expansion of the perforated tubulars within the wellbore.

79. A system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, comprising;

means for positioning one or more solid tubulars within the wellbore;

means for positioning one or more perforated tubulars within the wellbore each including one or more radial passages, the perforated tubulars traversing the producing subterranean zone;

means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore;

means for fluidicly coupling the solid tubulars with the casing;

means for fluidicly coupling the perforated tubulars with the solid tubulars;

means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore;

means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone; and

means for cleaning materials from the radial passages of at least one of the perforated tubulars by further radial expansion of the perforated tubulars within the wellbore.

Amendments to the claims have been filed as follows

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CLAIMS

1. An apparatus, comprising:

a zonal isolation assembly comprising:

one or more solid tubular members, each solid tubular member including one or more external seals;

one or more perforated tubular members coupled to the solid tubular members, the perforated tubular members defining a longitudinal flow passage;

one or more flow control valves operably coupled to the perforated tubular members for controlling the flow of fluidic materials through the perforated tubular members;

one or more temperature sensors located within the longitudinal flow passage of one or more of the perforated tubular members for monitoring the operating temperature within the perforated tubular members;

one or more pressure sensors located within the longitudinal flow passage of one or more of the perforated tubular members for monitoring the operating pressure within the perforated tubular members; and

one or more flow sensors located within the longitudinal flow passage of one or more of the perforated tubular members for monitoring the operating flow rate within the perforated tubular members; and

a shoe coupled to the zonal isolation assembly; and

a controller operably coupled to the flow control valves, the temperature sensors, the pressure sensors, and the flow sensors for monitoring the temperature, pressure and flow sensors and controlling the operation of the flow control valves; and

wherein at least one of the solid tubular members and the perforated tubular members are formed by a radial expansion process performed within a wellbore; and

an expansion cone adapted to radially expand at least one of the solid tubular members or at least one of the perforated tubular members.

2. The apparatus of claim 1, wherein the expansion cone is adapted to operate under fluid pressure.

3. The apparatus of claim 1, wherein the expansion cone comprises an outer surface comprising a parabolic outer profile.

4. The apparatus of claim 1, wherein the expansion cone comprises a first conical outer surface and a second conical outer surface.

5. The apparatus of claim 1, wherein the expansion cone comprises at least three adjacent conical outer surfaces.

6. The apparatus of claim 4, wherein the first conical outer surface comprises an angle of attack between 8° and 20°.

7. The apparatus of claim 4 or 6 , wherein the second conical outer surface comprises an angle of attack between 4° and 15°.

8. The apparatus of any one of claims 4-7, wherein the angle of attack decreases from a front end of the expansion cone to a back end of the expansion cone.

9. The apparatus of claim 1, wherein at least one of the solid tubular members and at least one of the perforated tubular members are coupled with a threaded connection.

10. The apparatus of claim 9, wherein the threaded connection is radially expanded within the wellbore.

11. A method of isolating a first subterranean zone from a second subterranean zone in a wellbore, comprising:

positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the second subterranean zone, the perforated tubular members defining a longitudinal flow passage;

radially expanding at least one of the primary solid tubulars and perforated tubulars within the wellbore, with an expansion device comprising a first conical outer surface and a second conical outer surface;

fluidicly coupling the perforated tubulars and the solid tubulars;

preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars;

monitoring the operating temperatures, pressures, and flow rates within the longitudinal flow passage of one or more of the perforated tubulars; and

controlling the flow of fluidic materials through the perforated tubulars as a

function of the monitored operating temperatures, pressures, and flow rates.

12. The method of claim 11, wherein the radially expanding comprises an expansion device.

13. The method of claim 12, wherein the expansion device comprises an expansion cone.

14. The method of claim 12, wherein the expansion device is adapted to operate under fluid pressure.

15. The method of claim 12, wherein the expansion device comprises a parabolic expansion device.

16. The method of claim 12, wherein the expansion device comprises a first conical outer surface and a second conical outer surface.

17. The method of claim 12, wherein the expansion device comprises at least three adjacent conical outer surfaces.

18. The method of claim 16, wherein the first conical outer surface comprises an angle of attack between 8° and 20°.

19. The method of claim 16 or 18, wherein the second conical outer surface comprises an angle of attack between 4° and 15°.

20. The method of any one of claims 16-19, wherein the angle of attack decreases from a front end of the expansion device to a back end of the expansion device.

21. The method of claim 11, wherein at least one of the solid tubular members and at least one of the perforated tubular members are coupled with a threaded connection.

22. The method of claim 21, wherein the threaded connection is radially expanded within the wellbore.

23. A method of extracting materials from a producing subterranean zone in a

wellbore, at least a portion of the wellbore including a casing, comprising;

positioning one or more solid tubulars within the wellbore;

positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the producing subterranean zone, the perforated tubular members defining a longitudinal flow passage;

radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, with an expansion device comprising a first conical outer surface and a second conical outer surface;

fluidicly coupling the solid tubulars with the casing;

fluidicly coupling the perforated tubulars with the solid tubulars;

fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore;

fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone;

monitoring the operating temperatures, pressures, and flow rates within the longitudinal flow passage of one or more of the perforated tubulars; and

controlling the flow of fluidic materials through the perforated tubulars as a function of the monitored operating temperatures, pressures, and flow rates.

24. The method of claim 23, wherein the radially expanding comprises an expansion device.

25. The method of claim 24, wherein the expansion device comprises an expansion cone.

26. The method of claim 24, wherein the expansion device is adapted to operate under fluid pressure.

27. The method of claim 24, wherein the expansion device comprises a parabolic expansion device.

28. The method of claim 24, wherein the expansion device comprises a first conical outer surface and a second conical outer surface.

29. The method of claim 24, wherein the expansion device comprises at least three adjacent conical outer surfaces.

30. The method of claim 28, wherein the first conical outer surface comprises an angle of attack between about 8° and about 20°.

31. The method of claim 28 or 30, wherein the second conical outer surface comprises an angle of attack between 4° and 15°.

32. The method of any one of claims 28-31, wherein the angle of attack decreases from a front end of the expansion device to a back end of the expansion device.

33. The method of claim 23 wherein at least one of the solid tubular members and at least one of the perforated tubular members are coupled with a threaded connection.

34. The method of claim 33 wherein the threaded connection is radially expanded within the wellbore.

35. A system for isolating a first subterranean zone from a second subterranean zone in a wellbore, comprising:

means for positioning one or more solid tubulars within the wellbore, the solid tubulars traversing the first subterranean zone;

means for positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the second subterranean zone, the perforated tubular members defining a longitudinal flow passage;

means for radially expanding at least one of the solid tubulars and perforated tubulars within the wellbore, comprising a first conical outer surface and a second conical outer surface;

means for fluidicly coupling the perforated tubulars and the solid tubulars;

means for preventing the passage of fluids from the first subterranean zone to the second subterranean zone within the wellbore external to the solid tubulars and perforated tubulars;

means for monitoring the operating temperatures, pressures, and flow rates within the longitudinal flow passage of one or more of the perforated tubulars; and

means for controlling the flow of fluidic materials through the perforated tubulars as a function of the monitored operating temperatures, pressures, and flow rates.

36. The system of claim 35 wherein the means for radially expanding comprises an

expansion device adapted to radially expand at least one of the solid tubular members or at least one of the perforated tubular members.

37. The system of claim 36 wherein the expansion device comprises an expansion cone.

38. The system of claim 36 wherein the expansion device is adapted to operate under fluid pressure.

39. The system of claim 36 wherein the expansion device comprises a parabolic expansion device.

40. The system of claim 36, wherein the expansion device comprises a first conical outer surface and a second conical outer surface.

41. The system of claim 36, wherein the expansion device comprises at least three adjacent conical outer surfaces.

42. The system of claim 40, wherein the first conical outer surface comprises an angle of attack between 8° and 20°.

43. The system of claim 40 or 42, wherein the second conical outer surface comprises an angle of attack between 4° and 15°.

44. The system of any one of claims 40-43, wherein the angle of attack decreases from a front end of the expansion device to a back end of the expansion device.

45. The system of claim 35, wherein at least one of the solid tubular members and at least one of the perforated tubular members are coupled with a threaded connection.

46. The system of claim 45, wherein the threaded connection is radially expanded within the wellbore.

47. A system for extracting materials from a producing subterranean zone in a wellbore, at least a portion of the wellbore including a casing, comprising;

means for positioning one or more solid tubulars within the wellbore;

means for positioning one or more perforated tubulars within the wellbore, the perforated tubulars traversing the producing subterranean zone, the perforated tubular members defining a longitudinal flow passage;

means for radially expanding at least one of the solid tubulars and the perforated tubulars within the wellbore, comprising a first conical outer surface and a second conical outer surface;

means for fluidicly coupling the solid tubulars with the casing;

means for fluidicly coupling the perforated tubulars with the solid tubulars;

means for fluidicly isolating the producing subterranean zone from at least one other subterranean zone within the wellbore;

means for fluidicly coupling at least one of the perforated tubulars with the producing subterranean zone;

means for monitoring the operating temperatures, pressures, and flow rates within the longitudinal flow passage of one or more of the perforated tubulars; and

means for controlling the flow of fluidic materials through the perforated tubulars as a function of the monitored operating temperatures, pressures, and flow rates.

48. The system of claim 47, wherein the means for radially expanding comprises an expansion device adapted to radially expand at least one of the solid tubular members or at least one of the perforated tubular members.

49. The system of claim 48, wherein the expansion device comprises an expansion cone.

50. The system of claim 48, wherein the expansion device is adapted to operate under fluid pressure.

51. The system of claim 48, wherein the expansion device comprises a parabolic expansion device.

52. The system of claim 48, wherein the expansion device comprises a first conical outer surface and a second conical outer surface.

53. The system of claim 48, wherein the expansion device comprises at least three adjacent conical outer surfaces.

54. The system of claim 52, wherein the first conical outer surface comprises an angle of attack between 8° and 20°.

55. The system of claim 52 or 54. wherein the second conical outer surface comprises an angle of attack between 4° and 15°.

56. The system of any one of claims 52-55, wherein the angle of attack decreases from a front end of the expansion device to a back end of the expansion device.

57. The system of claim 47, wherein at least one of the solid tubular members and at least one of the perforated tubular members are coupled with a threaded connection.

58. The system of claim 57, wherein the threaded connection is radially expanded within the wellbore.

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Application No: GB0500600.2 **Examiner:** Nicholas Mole

Claims searched: 1-5,7-65 **Date of search:** 10 February 2005

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Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
A		GB 2348223 A (SHELL)

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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The following online and other databases have been used in the preparation of this search report

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